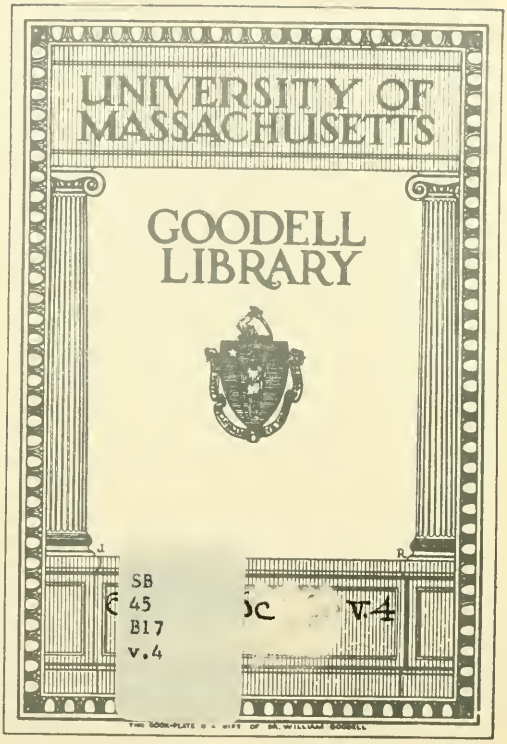
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Cyclopedia of American Horticulture

Plate XX. Various types of garden Narcissus

CYCLOPEDIA OF AMERICAN HORTICULTURE

COMPRISING SUGGESTIONS FOR CULTIVATION OF HORTICULTURAL PLANTS, DESCRIPTIONS OF THE SPECIES OF FRUITS, VEGETABLES, FLOWERS AND ORNAMENTAL PLANTS SOLD IN THE UNITED STATES AND CANADA, TOGETHER WITH GEOGRAPHICAL AND BIOGRAPHICAL SKETCHES

AND

A SYNOPSIS OF THE VEGETABLE KINGDOM

BY

L. H. BAILEY

ASSISTED BY

WILHELM MILLER, PH.D.

Associate Editor

AND MANY EXPERT CULTIVATORS AND BOTANISTS

Illustrated with nearly Three Thousand Engravings and One Hundred and Forty-five Full-page Half-tones

IN SIX VOLUMES—VOLUME IV

M–PHY.

FOURTH EDITION

New York

DOUBLEDAY, PAGE & COMPANY

1906

Mount Pleasant Press
J. Horace McFarland Co.
Harrisburg, Pa.

M

MAACKIA. See *Cladrastis.*

MÀBA (native name). *Ebenàceæ.* A genus of about 60 species of trees and shrubs found in the warmer regions of the world. They mostly have hard, ebony-like wood. Closely allied to Diospyros, the floral parts mostly in 3's instead of 4's or 5's. The lvs. are usually smaller than in Diospyros. Lvs. alternate: fls. axillary, solitary or in short cymes, usually dicœcious; corolla bell-shaped or tubular.

Natalénsis, Haw. Much-branched shrub, with flexuous branches: lvs. ¾–1 in. long, 6–7 lines wide, ovate, oblong or elliptical, obtuse, dark green above, paler beneath, glabrous, netted-veined beneath: female fls. solitary; calyx cup-shaped, glabrous, entire; abortive stamens 6–7: ovary glabrous. Natal; offered in S. Fla.—Presumably the plant in cult. is the female.

MACADÀMIA (after John Macadam, M.D., secretary Philosophical Institute, Victoria, N. S. W.). *Proteàceæ.* Two or 3 species of Australian trees or tall shrubs, one of which produces the Australian nut, which has a flavor like a filbert or almond, and is cult. in S. Calif. In favorable localities it bears in 7 years. The genus has no near allies of horticultural value. Lvs. whorled: fls. small, pedicelled in pairs, racemose, hermaphrodite; perianth not recurved; stamens affixed a little below the blades: disk ringed, 4-lobed or 4-parted.

ternifòlia, F. Muell. Australian Nut. Tree, attaining 60 ft.: foliage dense: lvs. sessile, in whorls of 3 or 4, oblong or lanceolate, serrate, with fine prickly teeth, glabrous and shining, a few inches to 1 ft. long: racemes often as long as the lvs.: fr. with a 2-valved, leathery covering; nut often over 1 in. thick. Australia. G.C. 1870:1181.

MACHÆRIUM Tipu. See *Tipuana speciosa.*

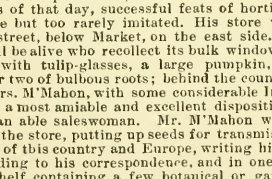
MACKÀYA. See *Asystasia.*

MACLEÀNIA (after John Maclean, British merchant at Lima, Peru; patron of botany). *Vaccinèaceæ.* About a dozen species of shrubs found in the mountains from Mexico to Peru. They are unknown to the American trade, but, judging from the pictures in the Botanical Magazine, should make fine bothouse subjects for our largest and finest conservatories. They have clusters of brick-red or crimson, tubular fls. each an inch or more long. A branch of *M. speciosissima,* which is probably the showiest kind, bears about 60 to 75 such fls. The young foliage appears to have a handsome reddish tinge. The corollas are strongly 5-angled, and the 5 tips are short, triangular, erect or spreading and more or less yellow. Lvs. evergreen, alternate, short-stalked, entire: stamens 10, much shorter than the corolla. Macleanias are probably of difficult culture. Try *M. speciosissima* in a large pot on a shelf near the glass, so that its branches may hang gracefully. *M. pulchra* has the same habit and color of fls., but is perhaps less desirable. *M. punctata* is perhaps the most desirable of those with erect branches and stiff habit. Try this in a warmhouse border, with good drainage and shallow soil, as some of these Macleanias have thick, fleshy roots and the fibrous roots are said to keep near the surface.

MACLÙRA, or OSAGE ORANGE. See *Toxylon.*

M'MAHON, BERNARD (about 1775 to September 16, 1816), horticulturist, was born in Ireland and came to America, for political reasons, in 1796. He settled in Philadelphia, where he engaged in the seed and nursery business. He early began the collection and exportation of seeds of American plants. In 1804 he published a catalogue of such seeds, comprising about 1,000 species. He was the means of making many of our native plants known in Europe. He enjoyed the friendship of Jefferson and other distinguished men, and his seed store became a meeting place of botanists and horticulturists. He was interested in all branches of horticulture. It is thought that the Lewis & Clark expedition was planned at his house. At all events, M'Mahon and Landreth were instrumental in distributing the seeds which those explorers collected (see p. 767). In 1806, he gave to America its first great horticultural book, "American Gardener's Calendar" (see p. 760), which was long a standard cyclopedic work. The editor of the eleventh edition of this book (1857) makes the following reminiscence of M'Mahon:

"Bernard M'Mahon was no common man. He sought the American shores from political motives, as is understood, but what these were has not been determined; most probably it was necessary to fly from the persecution of government. He found American gardening in its infancy, and immediately set himself vigorously to work to introduce a love of flowers and fruit. The writer well remembers his store, his garden and greenhouses. The latter were situated near the Germantown turnpike, between Philadelphia and Nicetown, whence emanated the rarer flowers and novelties, such as could be collected in the early part of the present century, and where were performed, to the astonishment of the amateurs of that day, successful feats of horticulture that were but too rarely imitated. His store was on Second street, below Market, on the east side. Many must still be alive who recollect its bulk window, ornamented with tulip-glasses, a large pumpkin, and a basket or two of bulbous roots; behind the counter officiated Mrs. M'Mahon, with some considerable Irish accent, but a most amiable and excellent disposition, and withal, an able saleswoman. Mr. M'Mahon was also much in the store, putting up seeds for transmission to all parts of this country and Europe, writing his book, or attending to his correspondence, and in one corner was a shelf containing a few botanical or gardening books, for which there was then a very small demand; another contained the few garden implements, such as knives and trimming scissors; a barrel of peas and a bag of seedling potatoes, an onion receptacle, a few chairs, and the room partly lined with drawers containing seeds, constituted the apparent stock in trade of what was one of the greatest seed stores then known in the Union, and where was transacted a considerable business for that day. Such a store would naturally attract the botanist as well as the gardener, and it was



1343. Madia elegans. (See p. 964.)

the frequent lounge of both classes, who ever found in the proprietors ready listeners, as well as conversers; in the latter particular they were rather remarkable, and here you would see Nuttall, Baldwin, Darlington, and other scientific men, who sought information or were ready to impart it."

M'Mahon's name was given to west-coast evergreen barberries by Nuttall in 1818, and these shrubs are still known as Mahonias to horticulturists, although united with Berberis by botanists. L. H. B

MACODES (from *makos*, length; on account of the long labellum). *Orchidàceæ*. Contains but 2 or 3 species of the habit of Anœctochilus, which see for culture. Sepals and narrower petals spreading: labellum ventricose, with 2 small lateral lobes and 2 calli inside, turned to one side: column short, twisted in the opposite direction, with 2 narrow, erect appendages. Terrestrial herbs, with few variegated petioled lvs. at the base, and small fls. borne in a long raceme.

Pétola, Lindl. (*Anœctochìlus Veitchiànus*, Hort.). Fls. greenish, inconspicuous: lvs. ovate, 2–3 in. long, reticulated with golden yellow veins. Java. R.B 21:61.

HEINRICH HASSELBRING.

MACROCHÓRDIUM strictum, Beer, once advertised by Pitcher & Manda, is referred by Mez to *Æchmea bromeliæfolia*, Baker. See p. 28, Vol. I. It is *Bromelia melanantha*, Ker-Gawl, B. R. 9:766. The species is characterized by white-scurfy lvs., simple dense, woolly spikes overtopping the foliage: fls. with yellowish green calyx and small exserted purple-black petals. S. Amer.

MACROSCÈPIS (Greek, *macros*, long; *skepo*, to cover). *Asclepiadàceæ*. A genus of about 8 species of tall, tropical American climbers, of which **M. elliptica,** Hort. Sander, was int. in 1899. Sander & Co. describe it as "a new climbing stove-plant, with elliptic, light green leaves, which, together with the stems, are densely covered with soft, felt-like, yellow-brown hairs. The fls. are in clusters, each flower about 1 in. in diam., resembling in shape those of *Hoya carnosa*, and borne in similar bunches; they are of a soft, velvety, rich brown color. Every part of the plant, when bruised or pressed, is strongly odorous."

Generic characters are: lvs. opposite, large, cordate: cymes crowded: fls. white; calyx about 5-parted; corolla tube thick; limb spreading: scales of the crown 5, inflexed under the throat of the fleshy corolla.

MACROTÔMIA. Consult *Arnebia*.

MACROZÂMIA (Greek, *long Zamia*). *Cycadàceæ*. About 5–7 Australian cycads, which, like most of the members of this order, make noble foliage plants for private conservatories. They have the trunk and lvs. of Cycas, except that the pinnæ have no midrib but are more or less distinctly striate, especially on the under side, with several parallel equal veins, the whole leaf occasionally twisted in some species, but not constantly so in any one.

The genus is more nearly allied to Dioon and Encephalartos, from which it is distingnished by the following characters: lvs. pinnate: scales of the female cones peltate, the shield thickened, ascending, usually produced into an erect, acuminate blade. Botanically the group is very imperfectly understood. The writer has followed Bentham's account in Flora Australiensis 6:250 (1873).

Macrozamias are representative rather than useful subjects, and not frequently seen. They combine poorly in any scheme of plant and flower decoration; but as single specimens, they always attract attention, and in a grouping of similar subjects, or with aloes, agave and yuccas they make an effective combination. Their culture is easy. Sandy soil, with charcoal to keep the soil sweet, ordinary greenhouse temperature, plenty of water during the growing season, which corresponds to our summer, and rest in winter, are the essentials.

At present *M. spiralis* is the only name in American trade catalogues, but the other kinds were offered in 1893 and 1895 by John Saul, and Pitcher & Manda.

A. *Pinnæ very narrow, often nearly terete: cones small, rarely above 4 in.: fr. very woolly.*

Paulo-Guiliélmi, Hill & Muell. (*M. plumòsa*, A. Mohr.). Trunk short: lvs. 1–3 ft. long. R.H. 1877, p. 254.

AA. *Pinnæ flat, inserted on the margins of the rachis, contracted at the base: cones 4–10 in., glabrous.*

B. *Rachis of lvs. usually raised longitudinally between the pinnæ: cone scales much flattened.*

spiràlis, Miq. Trunk short: lvs. 2–4 ft. long: insertion of the pinnæ mostly longitudinal: points of the scales usually short. G.C. III. 13:74.—*M. cylindrica*, C. Moore, is a distinct species according to Index Kewensis, but Bentham considered it a doubtful variety of *M. spiralis*, being smaller, with the narrow foliage nearly of *M. Paulo-Guilielmi*, but with a glabrous trunk and more terete rachis.

BB. *Rachis of lvs. very flat between the pinnæ and often broad: cone scales very thick.*

Miquélii, DC. Cult. abroad. John Saul advertised *M. Macgui*, presumably a typographical error either for *M. Miquelii* or else *M. Macleayi*, Miq., which = *M. spiralis*.

AAA. *Pinnæ inserted by their broad base along the center of the upper surface of the rachis, scarcely separated by a very narrow line: cones large, pubescent, the scale points broad and often recurved.*

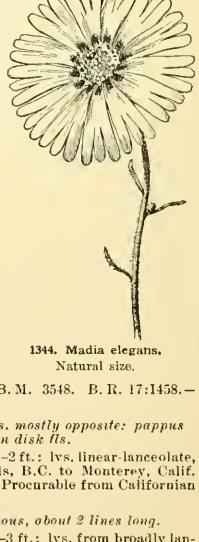
Perofskyàna, Miq. (*M. Perowskiàna*, F. Muell.). Largest and most distinct: trunk 18–20 ft. high: lvs. 7–12 ft. long.

T. D. HATFIELD and W. M.

MADDER. The root of *Rubia tinctorum*.

MADEIRA VINE is *Boussingaultia*.

MÀDIA (*Madi*, the Chilean name of the common species). *Compósitæ*. Nine species of yellow-fld. herbs confined to the western part of the American continent. Their fls. are remarkable for closing in the sunshine, and opening in the morning or evening. They are all called Tarweeds from their glandular, viscid, heavily-scented foliage, the common Tarweed of Calif. being var. *congesta* of *M. sativa*, which is a useful annual plant for sheep pastures in dry, warm soil. *M. elegans* is an ornamental annual which every one should try. It has a graceful open habit (see Fig. 1343) and distinct fls. (Fig. 1344), which become more numerous as the summer advances. The nearest genus of garden value is Layia, from which Madia is distinguished by the following characters: involucre deeply sulcate, bracts strongly involving the akenes of the rays: akenes of the disk fertile or sterile.



1344. Madia elegans. Natural size.

A. *Rays showy.*

B. *Plant annual: lvs. chiefly alternate: pappus none.*

élegans, D. Don. Figs. 1343–4. Height 1–2 ft.: lvs. linear or lanceolate, mostly entire: rays acutely 3-lobed, yellow throughout or with a brown spot at the base. Ore. to Nev. B. M. 3548. B. R. 17:1458.—Needs a shady place.

BB. *Plant perennial: lvs. mostly opposite: pappus present in disk fls.*

Núttallii, Gray. Height 1–2 ft.: lvs. linear-lanceolate, sometimes dentate. Woods, B.C. to Monterey, Calif.—Adv. 1881 by E. Gillett. Procurable from Californian collectors.

AA. *Rays inconspicuous, about 2 lines long.*

sativa, Molina. Height 1–3 ft.: lvs. from broadly lanceolate to linear: rays 5–12. Ore., Calif., Chile. W. M.

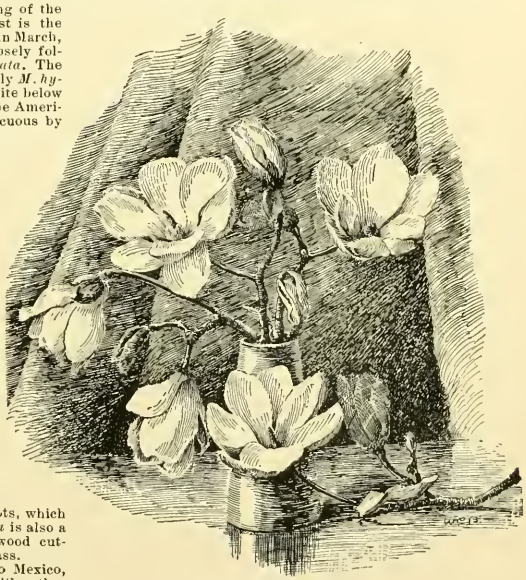
MAGNÒLIA (after Pierre Magnol, professor of medicine and director of the botanic garden at Montpellier, 1638–1715). *Magnoliàceæ*. Highly ornamental and popular deciduous or evergreen trees or shrubs, with alternate large, entire leaves and large white, pink or purple, rarely yellowish flowers, often fragrant; the

cone-shaped fruits are often pink or scarlet and very decorative. Most of the deciduous species are fairly hardy, at least in sheltered positions, as far north as northern N.Y. and Mass., and *M. acuminata*, *Kobus* and *stellata* even farther north, while *M. Campbelli* is the most tender. Of the evergreen species, *M. grandiflora*, one of the most beautiful native trees, is precariously hardy north to Philadelphia. The Asiatic deciduous species are among the most showy and striking of the early-flowering trees and shrubs; the earliest is the shrubby *M. stellata*, blooming in mild climates in March, and after this *M. Yulan* comes in bloom, closely followed by *M. Soulangeana* and after this *M. obovata*. The handsomest of the deciduous species is probably *M. hypoleuca*, with the very large leaves silvery white below and with showy, sweet-scented flowers; also the American *M. macrophylla* and *tripetala* are conspicuous by their very large foliage. The Magnolias are usually planted as single specimens on the lawn, and there are, perhaps, no plants more striking against a background of dark green conifers. Some species, as *M. grandiflora* in the South and *M. acuminata* farther north, are fine avenue trees. The Magnolias thrive best in somewhat rich, moderately moist and porous soil, preferring sandy or peaty loam, but some kinds which usually grow naturally on the borders of swamps, as *M. glauca*, thrive as well in moist and swampy situations. Transplanting is difficult and is most successfully performed just when the new growth is starting. Prop. by seeds sown immediately or stratified, and by layers of last year's growth put down in spring and tongued or notched. Layers are usually severed and transplanted the following spring, but as many of them die after transplanting, it is a safer way to take them off early in July, when the new growth has ripened, plant them in pots and keep in a close frame until they are established. Varieties and rarer kinds are often veneer- or side-grafted in early spring or summer on potted stock in the greenhouse or frame; as a stock *M. tripetala* is perhaps the best, on account of its better fibrous roots, which render transplanting safer, but *M. acuminata* is also a good stock Sometimes increased by greenwood cuttings taken with a heel and handled under glass.

About 20 species in N. America, south to Mexico, Himalayas and E. Asia. Trees and shrubs, with rather stout branches marked with conspicuous leaf-scars; stipules usually adnate to the petiole and inclosing the young successive leaf: fls. terminal, solitary, the buds inclosed in a stipular spathe; sepals 3, often petaloid; petals 6–15; stamens and carpels numerous, the latter connate into a spindle, developing into a cone-like somewhat fleshy or leathery fr., with dehiscent, 1–2-seeded carpels; the large, usually scarlet seeds often suspended for a time from the fr. by thin threads. The wood is close-grained, usually light and satiny, but not durable; that of *M. hypoleuca* is much used in Japan for laquered ware; the bark and fr. of some species have been used medicinally as a tonic and stimulant.

ALFRED REHDER.

Among the finest Magnolias cultivated in the South are the two native evergreen species *M. grandiflora* and *M. glauca*, and the exotics *M. pumila* and *fuscata*, the last being now referred to Michelia. *Magnolia grandiflora* is a noble tree. It is a native of the middle and southern sections of Georgia, South Carolina, Alabama, Louisiana and the upper districts of Florida, and is recognized as one of the grandest of all broad-leaved evergreen trees. In its native habitat it attains a height of from 75 to 100 feet, with very large, oval or lanceolate coriaceous leaves. The latter vary, however, from very broad to rather narrow, some with a rusty under surface, others quite smooth. The flowers vary also in size, the largest frequently measuring 10–12 in. in diameter when fully expanded; others do not attain more than half that size. They appear early in May, in some sections during the latter part of April, and continue until the end of June. Some trees produce a few flowers during August, and even as late as October, but these are exceptions. Each flower lasts from 2–4 days, when the petals fall and the cone-like fruit appears. This gradually increases in size until September, when the bright coral-red seeds are detached and hang on long filaments. The seed should be gathered when fully ripe, put in dry sand until February in the S., then in moist sand for a week or 10 days, when the resinous cuticle can be removed by washing.



1345. Magnolia Yulan (×¼).
Commonly known as *M. conspicua*.

Sow the cleaned seed in a box or coldframe, and as the plants show their second leaves pot off in small pots. In July, give a larger-sized pot, and the plants will be sufficiently large to plant in permanent place during the following autumn or winter. It is always advisable to take pot-grown plants, as they succeed better than plants taken up with bare roots. Magnolias are voracious feeders, and require rich soil and an abundance of plant-food. Their roots extend to a great length, and to bring out the stately beauty of this tree they should be given ample space. The wood is white, and valued for cabinet work. There are many forms cultivated in European nurseries, their main characteristics being in the size and form of the leaves and size of flowers. They are propagated by grafting, either by inarching or cleft- or tongue-graft. The latter should be done under glass, taking 2-year-old pot-grown seedlings. The fragrance of the flowers varies also, some flowers being more pungent than others, but, as a rule, the fragrance is pleasant. The principal varieties are *M. grandiflora* var. *gloriosa*, with fls. often measuring 14 in. in diameter; foliage broad and massive, brown on under surface. Seldom grows beyond 18–25 ft. Var. *præcox*, or early-flowering. Var. *rotundifolia*, with very dark green roundish lvs., rusty underneath.

Magnolia glauca, the Sweet Bay, is an evergreen tree in the southern states, becoming deciduous northward. It attains a height of 30 ft. in rich bottoms or swampy lands: lvs. oval, long or elliptical, with a glaucous under surface: fls. white, 3–4 in. in diameter, very fragrant, and produced from May to July. This tree is

not sufficiently appreciated as an ornamental one in landscape gardening.

Magnolia pumila, or *Talauma pumila*, is a very dwarf Chinese species, seldom growing more than 4 or 5 ft. high: lvs. smooth, elliptical, sharp-pointed, coriaceous: fls. 1–1½ in. in diameter, white or slightly tinged green, with 6–9 fleshy petals, which drop soon after the fls. expand. The fragrance is intense at night, and resembles a ripe pineapple. It thrives best in a rich, partially shaded soil, but a frost of 10° below the freezing point will injure it. It is therefore best to grow it as a conservatory plant. Prop. by ripened wood cuttings in bottom heat. As this plant is in bloom during nearly the whole year, and its delicate fragrance is unsurpassed, it is strange that it is so little known.

P. J. BERCKMANS.

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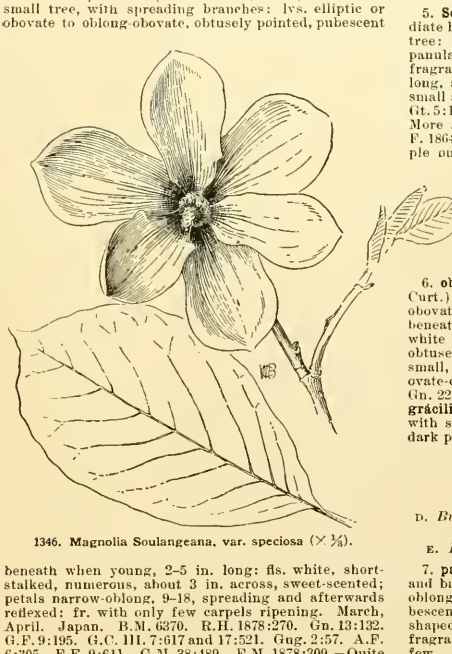
A. *Blossoms appearing before the lvs.*

B. *Petals 9–18.*

1. **stellàta**, Maxim. (*M. Halleàna*, Hort.). Shrub or small tree, with spreading branches: lvs. elliptic or obovate to oblong-obovate, obtusely pointed, pubescent



1346. Magnolia Soulangeana, var. speciosa (× ⅛).

beneath when young, 2–5 in. long: fls. white, short-stalked, numerous, about 3 in. across, sweet-scented; petals narrow-oblong, 9–18, spreading and afterwards reflexed: fr. with only few carpels ripening. March, April. Japan. B.M. 6370. R.H. 1878:270. Gn. 13:132. G.F. 9:195. G.C. III. 7:617 and 17:521. Gng. 2:57. A.F. 6:305. F.E. 9:611. G.M. 38:489. F.M. 1878:309.—Quite hardy and very free-flowering; it begins to flower when hardy 2 ft. high. Var. **rósea**, Hort., has the fls. blushed outside.

2. **Cámpbelli**, Hook. f. & Thoms. Tree, to 80 ft.: lvs. elliptic-oblong or ovate, abruptly acuminate, glaucous beneath and silky pubescent when young, 5–12 in. long: fls. cup-shaped, 6–10 in. across, white inside and pink, shaded with crimson, outside; petals obovate, 9–15: fr. greenish brown, 6–8 in. long. May. Himalayas. B.M. 6793. F.S. 12:1282–85. Gn. 48:1028; 53, pp. 167, 305. G.C. III. 23:89.—Beautiful tree, hardy only South.

BB. *Petals 6–9.*

C. *Fls. pure white.*

3. **Yúlan**, Desf. (*M. conspícua*, Salisb.). Fig. 1345. Tree, to 50 ft., with spreading branches: lvs. obovate or obovate-oblong, shortly pointed, pubescent beneath when young, 4–7 in. long: fls. large, campanulate, sweet-scented, about 6 in. across; petals and sepals almost alike, 9, concave, fleshy, 3–4 in. long: fr. brownish, 3–4 in. long, slender. April, May. Japan, China. B.M. 1621. L.B.C. 12:1187. G.C. III. 9:591. Gn. 21, p. 311; 23, p. 138; 24, p. 511; 31, p. 505; 34:667; 45, p. 365; 46, p. 145; 51, p. 474. G.M. 31:289; 36:386.—One of the most showy species.

4. **Kóbus**, Thunb. (*M. Thúrberi*, Hort.). Tree, to 80 ft., with narrow pyramidal head: branches short and slender: lvs. broadly obovate, abruptly pointed, tapering toward the base, pubescent below at first, 3½–6 in. long: fls. 4–5 in. across: sepals very small and narrow; petals 6, spreading, thin, 2–2½ in. long; fr. slender, dark brown, 4–5 in. long. April, May. Japan. G.F. 6:66.—One of the hardiest species but less showy; seems not to flower very profusely.

CC. *Fls. purplish or carmine outside.*

5. **Soulangeàna**, Soul. (*M. obovàta* × *Yúlan*). Intermediate between the parents. Popular large shrub or small tree: lvs. obovate to obovate-oblong: fls. large, campanulate, white, more or less purplish outside, often fragrant; sepals usually colored, sometimes almost as long, sometimes hardly half as long as petals, rarely small and greenish. May. A.G. 15:283. B.R. 14:1164. Gt. 5:166 and 168. S.B.F.G. I. 3:260. Var. **Lennéi**, Hort. More shrubby: fls. large, deep crimson outside, late. F. 1864:25. V. 5:196. Var. **nigra**, Hort. Fls. dark purple outside. There are many other named vars., like var. **Alexandrina**, **grándis**, **Norbertiàna**, **speciosa** (Fig. 1346), differing but little in color and flowering time, var. *Alexandrina* being one of the earliest, var. *Norbertiana* one of the latest in bloom. These hybrids are among the most popular Magnolias on account of their early, bright-colored fls.; they are showier and hardier than the following species.

6. **obovàta**, Thunb. (*M. discolor*, Vent. *M. purpùrea*, Curt.). Usually large shrub, with stout branches: lvs. obovate or oval-obovate, acute or acuminate, pubescent beneath at first, 4–7 in. long: fls. large, campanulate, white inside, purple outside, scentless; petals broad, obtuse, somewhat fleshy, about 3½ in. long; sepals small, ovate-lanceolate, greenish yellow: fr. brownish, ovate-oblong. May, June. China, Japan. B.M. 390. Gn. 22, p. 485; 24, p. 511; 46, p. 49. F.E. 9:611. Var. **grácilis**, Dipp. (*M. grácilis*, Salisb.).—Smaller shrub, with slender branches, narrower lvs. and smaller fls., dark purple outside.

AA. *Blossoms appearing after the lvs.*

B. *Foliage deciduous.*

C. *Fls. white.*

D. *Buds and branchlets glabrous or appressed pubescent: carpels glabrous.*

E. *Lvs. 4–7 in. long, scattered along the branches.*

7. **parviflòra**, Sieb. & Zucc. Small tree: branchlets and buds appressed pubescent: lvs. elliptic to obovate-oblong, obtusely pointed, glaucescent beneath and pubescent at first, 4–6 in. long: fls. long-pedicelled, cup-shaped, white, with large pink sepals, 3–4 in. across, fragrant; petals usually 6; stamens crimson; carpels few. June. Japan. B.M. 7411. Gn. 54, p. 177. Gng. 1:8; 3:3. G.M. 38:66.

Magnolia Soulangeana, the commonest hybrid magnolia in the North

8. **Wátsoni,** Hook. Closely allied to the former: almost glabrous, except lvs. beneath when young: lvs. obovate to oblong, 4–7 in. long: fls. short-stalked, 5–6 in. across, with 6–9 petals; carpels many. June. Japan. B.M. 7157. G.C. III. 16:189 and 17:517. Gt. 48:1459. Gng. 1:8. Gn. 24:417 (as *M. parviflora*) probably belongs here. G.M. 34:305.—Very handsome in bloom; the beauty of the large, sweet-scented flower is much heightened by the crimson center, formed by the bright-colored stamens.

EE. *Lvs. 8–20 in. long, mostly clustered at the end of the branches: buds and branches glabrous.*

9. **hypoleùca,** Sieb. & Zucc. Tree, to 100 ft. high, with broad, pyramidal head: lvs. obovate to obovate-oblong, obtusely pointed, glaucous and appressed pubescent beneath, 8–14 in. long: fls. 6–7 in. across, cup-shaped, fragrant, with 6–9 petals; stamens with scarlet filaments: fr. oblong-cylindric, scarlet, to 8 in. long. May, June. Japan. G.F. 1:305. Gng. 1:8. Mn. 3, p. 73.—One of the most beautiful of the deciduous species, the under side of the lvs. being almost silvery white; about as hardy as *M. macrophylla*.

10. **tripétala,** Linn. (*M. Umbrélla,* Lam.). Umbrella Tree. Tree, to 40 ft., with spreading branches, forming an open head: lvs. tapering toward the base, oblong-obovate, acute, pale and pubescent beneath when young, 12–24 in. long: fls. 8–10 in. across, of a disagreeable odor; petals 6–9, oblong-obovate, 4–5 in. long; sepals recurved, light green: fr. rose-colored, ovate-oblong, 2½–4 in. long. May. Pa. to Ala., west to Ark. and Miss. S.S. 1:9 and 10. Gn. 22, p. 27; 24, p. 509; 33, p. 539.

11. **Fràseri,** Walt. (*M. auriculàta,* Lam. *M. pyramidàta,* Pursh). Tree, to 40 ft., with wide-spreading branches, quite glabrous: lvs. obovate, cordate-auriculate at the base, acute, glaucescent beneath, 8–20 in. long: fls. 6–9 in. across, sweet-scented; petals 6–9, oblong-obovate, 4–5 in. long: fr. oblong, bright rose-red, 3–5 in. long. Va. to Fla., west to Miss. S.S. 1:11 and 12. B.M. 1206. B.R. 5:407. L.B.C. 11:1092. Gn. 22:27; 24, p. 511; 44, p. 935.

DD. *Buds and branches grayish tomentose: carpels woolly.*

12. **macrophýlla,** Michx. Large-leaved Cucumber Tree. Tree, to 50 ft., with spreading branches: lvs. oblong-obovate, blunt, subcordate-auriculate at the base, glaucescent and finely pubescent beneath, 1–3 ft. long: fls. cup-shaped, fragrant, 10–12 in. across; petals 6, oblong-obovate, thick, purplish at the base, 6–7 in. long: fr. broadly ovate, rose-colored, to 3 in. long. May, June. Ky. to Fla., west to Ark. and La. S.S. 1:7 and 8. B.M. 2981. G.F. 8:165. Gn. 22, p. 28; 24, p. 509; 33, p. 539.

CC. *Fls. yellow or greenish: petals 6, 2–3¼ in. long.*

13. **acuminàta,** Linn. Cucumber Tree. Tall, pyramidal tree, to 90 ft.: lvs. oval to oblong, shortly acuminate, rounded or acute at the base, soft pubescent and light green beneath, 6–9 in. long: fls. greenish yellow or glaucous green, about 2–3¼ in. high, with upright petals: fr. cylindric, pink, 3–4 in. long. May, June. N. Y. to Ga., west to Ill. and Ark. S.S. 1:4 and 5. B.M. 2427. L.B.C. 5:418. Gn. 24, p. 509.

14. **cordàta,** Michx. (*M. acuminàta,* var. *cordàta,* Sarg.). Similar to the former, but smaller: lvs. more pubescent, oval to ovate, acute, rounded or sometimes slightly cordate at the base: fls. smaller, canary yellow. Ga. and Ala. S.S. 1:6. B.M. 2427. L.B.C. 5:474. Gn. 22, p. 27; 24, p. 509.

BB. *Foliage coriaceous, persistent, but deciduous North in Nos. 15 and 16.*

C. *Lvs. glabrous or silky-pubescent beneath: usually shrubby.*

15. **Thompsoniàna,** Sarg. (*M. glaùca,* var. *mājor,* Sims. *M. glaùca,* var. *Thompsoniàna,* Loud.). Probable hybrid of *M. glauca* and *tripetala*. Shrub or small tree: branches and buds glabrous: lvs. oval to oblong, acute, glaucescent beneath and pubescent when young, 5–9 in. long: fls. white, fragrant, 5–6 in. across; sepals shorter than the petals, yellowish. June, July. G.F. 1:269. B.M. 2164. Gn. 24, p. 511.—Of garden origin.

16. **glaùca,** Linn. (*M. Virginiàna,* Morong). Sweet, Swamp or White Bay. Beaver Tree. Fig. 1347. Attractive shrub or small tree, evergreen South: lvs. oval to oblong-lanceolate, glaucous beneath and silky-pubescent at first, 3–6 in. long: fls. white, globose, fragrant, 2–3 in. across; sepals nearly as large as petals, spreading; petals 9–12, roundish obovate: fr. pink, 1–2 in. long. May, June. Mass. to Fla. near the coast, in the South extending west to Texas. S.S. 1:3. Em. 2:603. L.B.C. 3:215. R.H. 1894, p. 347. G.F. 10:403. Gng.

1347. Magnolia glauca (× ⅓).

4:342.—A very desirable shrub, with handsome, glossy foliage and sweet-scented, creamy white fls. Var. **longifòlia,** Loud., has lanceolate lvs. and continues blooming during a longer time than the type.

17. **pùmila,** Andr. (*Talaùma pùmila,* Blume). Shrub, to 12 ft.: lvs. elliptic-oblong, acuminate, glabrous, glaucescent beneath, 3–6 in. long: fls. axillary, nodding on short-curved pedicels, globose-ovate, white, fragrant, about 1¼ in. across; petals 6. China. B.M. 977.—Cult. South.

CC. *Lvs. ferrugineous, pubescent beneath: tree.*

18. **grandiflòra,** Linn. (*M. fœtida,* Sarg.). Bull Bay. Tall evergreen tree, to 80 ft., of pyramidal habit: branchlets and buds rusty-pubescent: lvs. thick and firm, oblong to obovate, glossy above, ferrugineous-pubescent beneath, sometimes glabrous at length, 5–8 in. long: fls. white, fragrant, 7–8 in. across; sepals large, petaloid; petals 6–12, obovate; stamens purple: fr. oval

or ovate, rusty brown and pubescent, 3–4 in. long. May–Aug. N. C. to Tex. S.S. 1:1 and 2.—Var. **angustifòlia**, Loud. (var. *salicifòlia*, Hort.). Lvs. lanceolate, wavy. Var. **lanceolata**, Ait. (var. *Exoniénsis*, Loud.). Lvs. oblong-lanceolate or oblong-elliptic, less rusty beneath. B.M. 1952. L.B.C. 9:814. There are many other named varieties, of which var. **Galissoniénsis**, Hort., has proved the hardiest in Europe. For other pictures, see Gn. 22, p. 28; 24, pp. 509, 511; 33, p. 538.

M. compréssa, Maxim. =Michelia compressa.—*M. fuscàta*, Andr.=Michelia fuscata.—*M. salicifòlia*, Maxim. Small, deciduous tree: lvs. elliptic to ovate-lanceolate, glaucous beneath, 4–7 in. long; fls. unknown. Japan. G.F. 6:67.

ALFRED REHDER.

MAHÉRNIA (anagram of *Hermannia*). *Sterculiàceæ*. More than 30 herbs and subshrubs of S. Africa, mostly with incised lvs. and drooping, bell-shaped fls. Calyx campanulate, 5-cleft; petals 5, with hollow claws, twisted in the bud; stamens 5, opposite the petals, the filaments prominently enlarged or dilated at about the middle (and thus differing from Hermannia, which has no sudden enlargement in the filaments), the anthers long: ovary 5-loculed, ripening into a coriaceous capsule with many seeds. Monogr. in Harvey and Sonder's Flora Capensis. By some the genus is united with Hermannia. A few of the Mahernias are cult. as pot-plants for the profusion of their bell-like fls. and the sweet odor.

1348. Mahernia verticillata. (×½.)

verticillàta, Linn. (*M. odoràta*, Hort, not of botanists, which is *Hermannia Presliana*). HONEY BELL. Fig. 1348. Very common plant in conservatories, and sometimes seen in window-gardens (see *House Plants*): half woody, very diffuse and straggly, not making a central leader, the terete crooked stems scabrous: lvs. small, much cut into linear divisions, with deep cut stipules: fls. ¾ in. or less long, nodding, usually about 2 together, from axillary shoots, sweet, fragrant, honey-yellow.—Free bloomer in winter and spring. Of easy cult. Prop. by cuttings. *Mahernia verticillata* is a very pretty twiggy bush for the cool greenhouse. The branches are long and flexible, so that specimens may be trained into any form. It may also be used for hanging baskets. It is of easy culture in pots, but lifts badly.

glabràta, Cav. Lvs. dentate or dentate-pinnatifid (not so finely cut as in the last), covered with stellate down: trailing.—It is doubtful if the plant cult. under this name is the *M. glabrata* of botanists.

L. H. B.

MAHOE, MOUNTAIN. See *Hibiscus elatus*.

MAHOGANY. See *Swietenia*. **Mountain Mahogany.** See *Cercocarpus*.

MAHÒNIA. Included with *Berberis*.

MAIDENHAIR FERN is *Adiantum*.

MAIDENHAIR TREE. See *Ginkgo*.

MAIÁNTHEMUM (Greek, *May flower*). *Liliàceæ*. **M. Convallària**, Weber, is a pretty little native wild flower growing 3–5 inches high, with 1–3 heart-shaped shining lvs., and a raceme about 1 in. long of small white fls., with 4-parted perianth and 4 stamens. It grows in moist woods, and is fully described in our manuals. It has been offered by dealers in native plants under its synonyms, *M. bifolium*, *Canadense* and *Smilacina bifolia*. B.B. 1:431. B.M. 510. It is sometimes called False Lily-of-the-Valley or Two-Leaved Solomon's Seal. Foliage dies in midsummer. Useful for early effects.

MAINE, HORTICULTURE IN. Fig. 1349. Maine, the most northeasterly of the United States, lies between latitudes 46° 6′ and 47° 27′ north and longitudes 66° 56′ and 71° 26′ west. The name was used by early explorers to designate the mainland as distinct from the numerous islands along the coast. Although its extreme breadth from east to west is but 270 miles, its coast line is so broken as to extend for 2,486 miles along the Atlantic. The total area of the state is 33,000 square miles, of which 3,145 is water surface. The surface of the state is disposed in two great slopes, separated by a broad plain from 1,000 to 2,000 feet above the sea (see the map). This plain, the eastern end of the Appalachian range, contains numerous hills and mountains, the highest of which is Mt. Katahdin, with an altitude of 5,385 feet.

The slopes are much broken by hills and lakes, and vast areas are still covered by the primeval forest. There is thus provided a wide diversity of soil and climatic conditions in different parts of the state, which affords opportunity for a considerable range in agricultural productions. Under these conditions, even from the earliest settlement of the state, agriculture has received a fair share of attention. There were in 1892, 65,000 farms, containing 6,500,000 acres, representing a cash value of $102,500,000, and an estimated value of farm products of $22,000,000.

The forests, located mainly in the middle belt, form one of Maine's principal sources of wealth. In the northern part these consist chiefly of pine, spruce, hemlock and arborvitæ. Farther south, in addition to the conifers, red oak, beech, birch, maple, ash and elm abound. Butternut and hickory are found, but are not abundant. The productions for which the state is especially noted, aside from lumber, are hay, potatoes, sweet corn and fruit. Of the first, from 1,500,000 to 2,000,000 tons are cut each year.

Potatoes form the staple crop in Aroostook county—the "Garden of Maine"—though many thousand bushels are grown in the southern counties. The annual crop is

1349. Maine. To illustrate its horticulture.

not far from 10,000,000 bushels. The greater portion of the potatoes grown in Aroostook county is converted into starch. The annual product of the starch factories is from 12,000,000 to 15,000,000 pounds. The average yield is about 120 bushels per acre, but as many as 500 and even 700 bushels have been obtained.

The production of sweet corn for canning has become an important industry in the southwestern and central parts of the state. The total pack in 1890 was about 12,000,000 cans, representing 3,000 acres. In 1892, 18,000,000 cans were packed, while in 1897 the output was about the same.

The rocky hillsides of southwestern Maine are especially suited for producing apples of superior color, flavor and keeping qualities. Pears and plums are also grown to a considerable extent. The value of the orchard products is about $1,500,000 annually. Desirable sites for orchards range in value from $5 to $50 per acre, according to the location and distance from shipping points.

Small fruits thrive over the greater part of the state, and find a ready market at the numerous summer resorts for which Maine is noted.

The canning of blueberries is an important industry in some parts of the state. In Washington county about 120,000 acres, otherwise worthless, are known as the "blueberry barrens." The annual output of the canning factories is valued at $75,000 to $100,000, and 1,500 or 2,000 bushels are shipped while fresh. In other parts of the state there are many thousand acres that may be utilized in the same way. Some of the more important blueberry regions are indicated by the shaded areas on the map.

In providing for education along agricultural lines, Maine has not been behind other states. While Arthur Young and others were striving to improve the agriculture of Great Britain, leading citizens of the then District of Maine united in forming one of the first agricultural societies in America. As noted by Boardman: "The light stations first established in this country for the improvement and the diffusion of agricultural literature were at Philadelphia, Pa., in 1785; Charleston, S. C., in 1785; Hallowell, Maine, 1787."

The first agricultural and industrial college in North America, the Gardiner Lyceum, was established at Gardiner, Me., in 1821, when a yearly grant of $1,000 was made by the state. The purpose of the school was "to give mechanics and farmers such a scientific education as would enable them to become skilled in their professions." This institution, under the patronage of the Vanghans and the Gardiners, flourished until 1835, when state aid was withdrawn. It was continued for two years at the expense of Mr. Gardiner, and then closed. In connection with the Lyceum, a farm was utilized for experiments in agriculture, and "to give the future agriculturist the knowledge of those principles of science upon which his future success depends, and an opportunity to see them reduced to practice."

In 1865 the State College of Agriculture and the Mechanic Arts was established under the provisions of the "Morrill Act." This, in 1897, became the University of Maine, with a well-equipped agricultural department. The Maine Agricultural Experiment Station, established under the provisions of the "Hatch Act" in 1887, forms a department of the university. In addition to the work of the university, important educational work is carried on in the form of farmers' institutes by the State Board of Agriculture, consisting of one member from each county, with permanent headquarters at the capital. There are also two state agricultural societies, one state pomological society, and nearly 50 county and town agricultural societies which receive aid from the state.

W. M. MUNSON

MAIZE. See *Corn* and *Zea*.

MAKART DECORATIONS and bouquets are dried grasses and everlastings, whether dyed or not. The celebrated painter, Hans Makart, once decorated his salon with dried palm leaves, pampas grass and the like, to the delight of the Emperor of Austria, who visited the artist's studio: hence the name. See *Everlastings* and G.C. III. 6:714.

MALAY APPLE. *Eugenia Jambos*.

MALCOLMIA. See *Malcomia*.

MALCÒMIA (Wm. Malcolm, English horticulturist of the eighteenth century). Also written Malcolmia, but it was originally spelled Malcomia. *Cruciferæ*. A genus of about 20 species, one of which is called the Virginian Stock, though it is a native of the Mediterranean region. It is a charming hardy annual of the easiest culture, growing about a foot high, with a more branching and open habit than the common stock (Matthiola), and 4-petaled fls. each about ¾ in. across. Red, white and crimson-fld. kinds are offered in America, while rose and lilac fls. appear in the mixtures. There seem to be no double forms. It is an excellent plant for the front of a border, as it may be easily had in bloom from spring to fall by means of successional sowings. Seeds are best sown in the fall, as they give earlier bloom. Seeds may be sown thinly. See *Annuals*.

1350. Virginian Stock, Crimson King.

Malcomia is a genus of branching herbs: branches often prostrate: lvs. alternate, entire or pinnatifid: fls. in a loose raceme; petals long and linear or long-clawed: pods rather terete, long or awl-shaped: seeds in 1 series or in 2 series at the base of the cells.

maritima, R. Br. VIRGINIAN STOCK. MAHON STOCK. Figs. 1350, 1351. Stem erect, branching: lvs. elliptic, obtuse, entire, narrowed at the base, pubescence appressed, 2–4-parted: pedicels rather shorter than the calyx: pods pubescent, long-acuminate at the apex. B.M. 166 (as *Cheiranthus maritimus*, showing red fls., changing to purple before fading). W. M.

MALLÒTUS (Greek, *woolly*). *Euphorbiàceæ*. Trees or shrubs, with broad opposite lvs., with small diœcious fls. in spikes or panicles: petals and disk absent; calyx 3–5-lobed; stamens numerous; styles 3, almost free, recurved; capsule spherical, splitting into 3 parts. About 80 species in the Old World tropics.

Japónicus, Müll. Arg. A small tree, with large, ovate, palmately nerved, nearly glabrous, sub-trilobed, long-petioled lvs.: spikes branched terminal: fls. 2–3 lines wide; stamens 60–70, yellow; stigmas slightly feathery: capsules pubescent, ½ in. in diam. Japan and China. R.H. 1894, p. 103.—Cult. at Santa Barbara.

J. B. S. NORTON.

MALLOW. *Malva rotundifolia*.

MALLOW, FALSE. *Malvastrum*.

MALÒPE (name used by Pliny for some kind of mallow). *Malvàceæ*. A genus of 10 species of annuals from the Mediterranean region, one of which is cult. under the name of *M. grandiflora*. It grows 1–3 ft. high, and bears red or white, 5-petaled fls. 2½–3 in. across, in summer and fall. The genus is allied to Althæa, which it resembles in having solitary ascending ovules, but has the carpels crowded into a sort of head without order, while in Althæa the carpels are in a single whorl. Also, Malope has 3 bractlets, while Althæa has 6–9. Herbs

glabrous or pilose: lvs. entire or 3-cut: fls. usually violet or rosy; bractlets large, cordate; calyx 5-cut; column of stamens divided at the top into filaments. Culture easy. See *Annuals*.

trífida, Cav. Lvs. 3-nerved, 3-cut, dentate, glabrous; lobes acuminate: peduncles axillary, 1-fld. Spain, N. Africa.—Var. **grandiflòra,** Paxt. (*M. grandiflòra*, F. G. Dietr.), is said to be much superior to the type, with fls. 2½–3 in. across, deep rosy red, veined inside darker. Gn. 21, p. 145. P.M. 1:177. *M. grandiflora alba* is also cult.

1351. Virginian Stock—Malcomia maritima.
Natural size. (See p. 969.)

MALPÍGHIA (Marcello Malpighi, 1628–1693, distinguished anatomist at Boulogne, who wrote on the anatomy of plants). *Malpighiàceæ*. About 20 species of small trees or shrubs, mostly natives of tropical America, one of which is the Barbadoes Cherry, *M. glabra*. The fruit is about the size and shape of a small northern cherry, but inferior in quality. It has an acid taste. It is borne on a shrub, which grows about 6 ft. high and has handsome crimson fls. of a distinct appearance. The fl. is about ¾ in. across, and the 5 petals have a claw about as long as the fringed blade. This shrub is a native of the West Indies and is cult. in all the Islands as well as S. Amer. It is also offered in S. Fla.

Malpighias have opposite, short-stalked lvs., glabrous or tomentose, entire or spiny-toothed: fls. axillary, clustered or corymbose, rarely solitary, red, rose or white; calyx 5-parted, 6–10-glandular; stamens 10: ovary 3-celled: styles 3, distinct: drupe 3-stoned, the stones with or without 3–5 crests or wings on the back.

glàbra, Linn. Barbadoes Cherry. Lvs. ovate, glabrous, entire, usually pointed, having a few biscuspidate hairs which disappear early: umbels 3–5-fld.: calyx 6–8 glandular: stones obtusely 4-angled. B.M. 813.

W. M.

MÀLUS. See *Pyrus*.

MÁLVA (old Latin name from Greek *malache;* referring to the emollient lvs.). *Malvàceæ*. About 16 species of herbs, widely scattered, 4 of which are cult. in America and have escaped from old gardens, while one, *M. rotundifolia* (Fig. 1352), the common Mallow, is a familiar weed. These plants are of the easiest culture, and bloom all summer and fall, having pink, rose or purple fls. sometimes 2 in. across. Malva is distinguished from numerous allied genera by the carpels in a single whorl: ovules solitary, ascending: bractlets 3, distinct: carpels not beaked or appendaged within. Malvas are hirsute or nearly glabrous: lvs. angled, lobed or dissected: fls. solitary, in the axils or clustered, sessile or peduncled; petals 5, notched at the apex. In the first 2 species the pedicels are solitary in the upper axils; in the next 3 they are numerous and clustered.

A. *Fls. large and showy, 1½–2 in. across.*

B. *Fruit downy, not wrinkled.*

moschàta, Linn. Musk Mallow. Perennial, 1–2 ft. high, less hairy than *M. Alcea:* stem-lvs. 3-many times parted, the lobes being linear: fls. rose or white; calyx with long, simple hairs. Eu.; cult. and escaped. R.H. 1851:381.

BB. *Fruit glabrous, minutely wrinkled or veiny.*

Álcea, Linn. Perennial, 2–4 ft. high: stem-lvs. parted almost to the base into 3–5 divisions, which are again 3–5-cut, the lobes broad: fls. deep rose; calyx densely stellate-pubescent. Eu.; cult. and escaped. B.M. 2297 (pink, veined deeper).—Var. **fastigiàta,** Koch (*M. Morénii*, Pollini). Lvs. less incised; upper stem-lvs. 3-fid; intermediate ones 5-fid; lobes oblong, unequally dentate. B.M. 2793.

BBB. *Fruit prominently wrinkled-veiny.*

sylvéstris, Linn. Biennial or perennial, 2–3 ft. high, rough-hairy, branching: lvs. rather sharply 5–7-lobed: fls. purple-rose. Eu., temp. Asia, waysides N. Amer. A.G. 13:471.—Not advertised. See *M. zebrina* in supplementary list. Var. **Mauritiàna** (*M. Mauritiàna*, Linn.) has long been cult. in cottage gardens abroad as the Tree Mallow. It is taller, smoother and has more obtuse lobes.

AA. *Fls. small, inconspicuous, whitish.*

B. *Lvs. curled or puckered at the margin.*

crispa, Linn. Curled Mallow. Unbranched annual, 4–6 ft. high, leafy from base to top: lvs. rounded, 5–7-lobed or angled: fls. clustered, almost sessile. Eu.; sparingly escaped from old gardens. Gn. 2, p. 315. Vilmorin's "Vegetable Garden," p. 319.—No longer advertised, but procurable abroad and still cult. in America. No part of the plant is eaten, but the elegantly crisped leaves are sometimes used for garnishing dishes. Generally self-sows in gardens.

1352. Malva rotundifolia (× ⅓).
A common weed, known as "Cheeses."

BB. *Lvs. not curled at the margins.*

rotundifòlia, Linn. Fig. 1352. Common Mallow. Stems trailing from a strong, deep root: lvs. rounded kidney-shaped, crenate; leaf-stalks very long: peduncles rather slender.—Common biennial or perennial weed, not cult. The flat wrinkled fruits are known to children as "cheeses." Also locally called "Shirt-button plant."

M. miniàta is a much confused name. In the Thorburn catalogue the plant in the American trade is said to be the same as Sphæralcea Munroana, probably on the authority of E. S. Carman in A. G. 11:539. M. miniata is also advertised by German dealers and is referred by Vilmorin's Blumengärtnerei to Sphæralcea miniata. Index Kewensis, however, refers M. miniata to Sphæralcea cisplatina. This riddle will, perhaps, be solved under Sphæralcea, which see.—*M. multifida alba*, Hort., is probably a white-fld. form of one of the species above mentioned, with foliage many times divided.—*M. zebrina*, Hort., is referred by Index Kewensis to M. sylvestris by Vilmorin's Blumengärtnerei to M. Mauritiana. In Bridgeman's catalogue M. zebrina is described as a hardy annual, called "Striped Mallow," growing 2 ft. high, with white and purple fls. W. M.

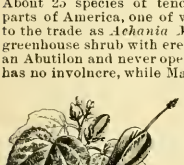
MALVÁSTRUM (name made from Malva). *Malvàceæ*. Sixty or more herbs and subshrubs in America and S. Africa, of which 2 or 3 are plants of minor importance in gardens. From Malva and its allies it differs in having short or capitate stigmas on the style-branches rather than longitudinal stigmas, also in having a solitary ovule in each carpel. From Malvaviscus it differs in having a dry rather than a baccate fruit, and in other characters. The garden species are perennials of easy culture, blooming in the hot weather of summer.

coccíneum, Gray. A tufted canescent plant, 5–10 in. or less high, with running rootstocks: lvs. not more than 1 in. across, pedately 3–5-parted or divided, the narrow divisions again cut or cleft: fls. brick-red or coppery, in a short terminal raceme: carpels round-kidney-shaped, inclosed in the incurving calyx lobes. Western Amer. B. M. 1673 (as *Cristaria coccinea*).—There is a var. **grandiflórum** in the trade, with "large deep scarlet fls."

campanulátum, Nichols. Two ft. or less high, hairy: lvs. pedately 3–5-lobed, the lobes deeply cut and toothed, clasping: fls. rose-purple, an inch across. Chile. P.M. 9:173, and R.H. 1843:325 (as *Malva campanulata*).

splendidum, Kell. Shrub, becoming 12 ft. or more, gray-tomentose: lvs. cordate-ovate, 5-lobed: fls. rosy pink, fragrant. Calif. L. H. B.

MALVAVÍSCUS (Greek, *sticky mallow*). *Malvàceæ*. About 25 species of tender shrubs from the warmer parts of America, one of which, *M. arboreus*, is known to the trade as *Achania Malraviscus*. It is a fine old greenhouse shrub with erect scarlet fls., which resemble an Abutilon and never open widely. Abutilon, however, has no involucre, while Malvaviscus has an involucre of 10–12 bractlets. Lvs. entire, dentate, angled or lobed: fls. red, usually peduncled; petals erect and connivent or spreading in the upper half; column of stamens truncate below the apex or 5-toothed: carpels fleshy outside, connate into a berry, later separating.



1353. Malvaviscus arboreus. (×⅛.)

arbóreus, Cav. (*Achània Malvaviscus*, Sw.). Fig. 1353. Tall shrub: lvs. alternate, mostly 3-lobed, acuminate, heart-shaped at the base, toothed: fls. convolute in the bud; bractlets erect. S. Amer. B. M. 2305.—Cult. outdoors in S. Fla. and S. Calif. *Malvaviscus arboreus* is one of the most satisfactory house plants that can be grown. It is not subject to insects of any kind, will stand a low temperature in winter, and blooms both winter and summer. When pot grown, the plant is usually about 2 ft. high, but outdoors it makes a strong, branching growth, attaining 3–5 ft. The bright scarlet fls. remain a long time in perfect condition. The fls. open slightly at the top or not at all. This circumstance gave rise to the old name Achania, which means *not opening*. The plant needs a good light soil and thrives in a compost of fibrous peat and loam. Prop. by cuttings. The cultivators need not fear the appearance of white grains on the surface of the lvs., as they are a normal, waxy secretion of the plant.

James Vick.

MAMILLARIA. See *Mammillaria*.

MAMMÉA (from a South American name). *Guttiferæ*. Six species of tropical trees, one of which, *M. Americana*, produces the fruits known as the Mammee Apple or St. Domingo Apricot. These are 3–6 in. in diameter, round, russet-colored or brown, with a yellow juicy pulp, and 1–4 large, rough seeds. The skin and seeds are bitter and resinous. The fruits are eaten raw without flavoring, or with wine and sugar, or sugar and cream. They are also preserved. The taste for them does not have to be acquired. The tree is cult. in S. Fla. and S. Calif., and a few fruits are brought from the West Indies to the U. S. The nearest ally of horticultural value is the Mangosteen, belonging to the genus Garcinia, characterized by having 4 sepals, while Mammea has a calyx which is closed before anthesis, and afterwards is valvately 2-parted. Mammeas have rigid, leathery lvs., often dotted with pellucid glands: peduncles axillary, 1-fld., solitary or clustered: fls. polygamous; petals 4–6; stamens numerous; stigma peltate or broadly lobed: ovary 2–4-celled.

Americàna, Linn. Mammee Apple. St. Domingo Apricot. Fig. 1354. Tree, 40–60 ft. high: lvs. obovate-oblong, rounded at tip, 4–8 in. long: peduncles few or solitary: petals white, fragrant; anthers oblong, laterally dehiscent. B.M. 7562. W. M.

Mammea Americana is native from the West Indies to Brazil. The wood is durable and well adapted for building purposes, posts and piles. It stands damp. It is beautifully grained and is used for fancy work. The gum is applied to extract chigoes; dissolved in lime-juice it destroys maggots in sores at a single dressing. An infusion of the bark is astringent and is useful to strengthen the recent cicatrices of sores. A liqueur has been obtained by distillation from the flowers infused in spirits of wine, known in the Island of Martinique by the name of "*Creme des Creoles*." The fruit is the size of a very large orange. It has a sweetish, somewhat aromatic taste and a peculiar odor. Not much use is made of it. Seeds germinate freely, and young plants are easily raised. W. Harris.

MAMMEE APPLE. See *Mammea*.

MAMMILLÀRIA (Latin, *mammila*; referring to the nipple-like tubercles on these plants). Often but not originally spelled *Mamillaria*. Stems simple, branching or in clusters from the root, commonly hemispherical or short-cylindrical, but often depressed or sometimes much elongated; the surface entirely broken up into tubercles (mamillæ): fls. usually short-funnelform, with naked or nearly naked tube and ovary, borne in the more or less woolly axils between the tubercles, or at the inner extremity of a narrow groove on their upper surface: fr. globose to linear-clavate, nearly always smooth and berry-like. The first subgenus is rather indefinitely separated from the tuberculate Echinocacti by the smooth fruit, and by the character of the groove, which in Mammillaria is hardly more than an impressed line, while in Echinocactus it is shorter and so broad as to be obviously a continuation of the spinliferous areola.

The cultivation of Mammillaria differs in no respect from Echinocactus, which see.

Review of Subgenera.

Subgenus I. Corvphantha (flowering in vertex). Tubercles, at least the flowering ones, narrowly grooved on the upper side, from apex nearly to base, except in *M. macromeris*. Fls. showy, large for the genus. Fruit green or greenish, except in *M. tuberculosa* and *M. Missouriensis*. Seeds brown, lightly reticulated and thin-shelled, with ventral or subventral hilum, except in *dasyacantha* and *Missouriensis*. Species 1–24

Subgenus II. Dolicothele. Tubercles cylindric-conical, long, loose and of soft texture. Fls. large, yellow, from the axils of the upper tubercles..... Species 25

Subgenus III. Cochemiea. Stems elongated, forming large clumps: fls. in a crown near the apex, 1½–2 in. long, narrowly tubular-funnelform, somewhat curved and bilabiate, with widely spreading sepaloid scales, the whole flower uniformly waxy red; stamens and style exceeding the petals: fr. red: one or more centrals hooked, except sometimes in *M. Halei*. All from Lower California and adjacent islands. ..... Species 26–29

1354. Mammea Americana—Mammee Apple, or St. Domingo Apricot (×¼). (See page 971.)

Subgenus IV. EUMAMILLARIA. Fls. usually small, produced from the axils of grooveless tubercles, and nearly always remote from the vertex: fr. usually clavate and red, nearly always destitute of scales.....Species 30–77

SUBGENUS I. CORYPHANTHA.

A. *Blossoms yellow: spines mostly yellow or yellowish, one or more honey-glands usually found in the groove.*
B. *Fls. remote from the vertex.*
C. *Glands one or two conspicuous red or yellow, in the axils: stems long, in age making large clumps: spines rather slender: radials ⅛–½ in. long, centrals ½–¾ in. long...* 1. **raphidacantha**
2. **macrothele**
3. **erecta**
CC. *Glands none in the axil...* 4. **recurvata**
BB. *Fls. central or nearly so: plants mostly globose or depressed, 1½–3 in. in diameter: radial spines laterally compressed near the base.....* 5. **Scheerii**
6. **robustispina**
C. *Stems nearly always simple: radial spines rather rigid and pectinately spreading: centrals 1–4, the upper turned up among the radials, the lower deflexed or horizontal. Species closely related and perhaps confluent.....* 7. **cornifera**
8. **daimonoceras**
9. **echinus**
10. **scolymoides**
CC. *Centrals none.....* 11. **radians**
12. **pectinata**
13. **impexicoma**
CCC. *Stems cespitose from the grooves of the tubercles, often densely so: groove without glands but often spinose for most of its length: radial spines fewer and weaker: central solitary or wanting.....* 14. **eulcata**
15. **Nickelsæ**
16. **Missouriensis**

AA. *Blossoms purple or purplish: spines usually gray or glossy, the centrals and tips black or brown: ovary and fruit often scale-bearing.*
B. *Radial spines 10 or more, often very numerous, covering the whole plant: centrals at maturity rarely less than 4.*
C. *Glands small in a chain in some of the grooves: spines long but weak, not obscuring the body.....* 17. **macromeris**
CC. *Glands none in axil or groove so far as known..* 18. **conoidea**
19. **vivipara**
20. **radiosa**
21. **dasyacantha**
22. **tuberculosa**
BB. *Radial spines less than 10: central solitary or wanting: tubercles large and broad..* 23. **cornuta**
24. **elephantidens**

SUBGENUS II. DOLICOTHELE.

25. **longimamma**

SUBGENUS III. COCHEMIEA.

26. **Roseana**
27. **setispina**
28. **Pondii**
29. **Halei**

SUBGENUS IV.

A. *Juice watery: tubercles rarely angular.*
B. *Spines (hooked) none: fls. yellowish or whitish, with rosy streaked petals.*
C. *Stems proportionately slender: tubercles short-ovate: radial spines rigid, spreading, recurved so that the points hardly project.....* 30. **elongata**
31 **Leona**
CC. *Stems low, usually broader than high. No bristles in the axils, except in M. candida and M. plumosa.*
D. *Radial spines few, not hiding the body.....* 32. **decipiens**
33. **fragilis**
DD. *Radial spines numerous, snowy white, covering and hiding the whole plant.....* 34. **lasiacantha**
35. **plumosa**
36. **senilis**
37. **barbata**
38. **vetula**
39. **candida**

BB. *Spines one or more hooked and central, except in M. pusilla and M. dioica insularis.*
C. *Bristles one or more found in the axils between the tubercles*
40. **pusilla**
41. **Bocasana**
42. **Wildii**
43. **tetrancista**
44. **dioica**
45. **armillata**
CC. *Bristles none in the axils, except perhaps in M. Carretii*
46. **Wrightii**
47. **Goodrichii**
48. **Grahami**
49. **venusta**
50. **Mainæ**
51. **Carretii**
AA. *Juice milky none in the tubercles, but found or to be suspected in the body. No hooked spines. Radial spines less than 15; centrals usually 1.*
B. *Fls. yellow*
52. **eriacantha**
BB. *Fls. blood-red*
53. **sphacelata**
BBB. *Fls. carmine*
54. **spinosissima**
55. **rhodantha**
56. **dolichocentra**
57. **discolor**
58. **Lesaunieri**
59. **Haageana**
60. **elegans**
AAA. *Juice milky exuding from wounds in any part of the plant; stems not elongated: tubercles usually angular: no hooked spines, except in M. uncinata. Section Lactescentes.*
B. *Fls. red or purple or carmine, —said to be yellow in Parkinsonii.*
C. *Spines terete: radials white, setaceous, numerous, interwoven and covering the plant; stems at length cylindrical or clavate; axils woolly*
61. **bicolor**
62. **Parkinsonii**
63. **formosa**
CC. *Spines few, stouter, often angular, some of the centrals very long and more or less flexuous: tubercles rather large, angled: axils woolly*
64. **angularis**
65. **centricirrha**
66. **mutabilis**
67. **Heeseana**
BB. *Fls. whitish, yellowish or flesh-color.*
C. *Radial spines 9–22, seldom less than 12: tubercles slender, scarcely angled.*
68. **simplex**
69. **Brandegei**
70. **Heyderi**
CC. *Radial spines rarely as many as 9: body mostly depressed*
71. **meiacantha**
72. **carnea**
73. **uncinata**
74. **Trohartii**
75. **sempervivi**
76. **Caput-Medusæ**
77. **micromeris**

INDEX.

1. **raphidacántha**, Lem. Stems becoming 1 ft. or more long, 2–3 in. in diam., often clavate: tubercles erect-spreading, somewhat flattened, often with 1 or 2 glands in the groove: spines yellow in the young state, soon gray; radials 6–10; central 1, longer and stouter, straight or hooked in the same plant: fls. about 1 in. broad. San Luis Potosi, Mex.—The more constautly hooked form is *M. ancistracantha*, Lem.

2. **macrothèle**, Mart. (*M. aulacothèle*, Lem. *M. Lehmanni*, Otto), Stems stout, attaining nearly 2 ft. in height by 4 in. in diam.: tubercles long, conical, at first upright, in age becoming even deflexed: spines all yellow; radials 6–8, spreading; centrals 1–2, longer and stouter: fls. 1½–2 in. broad. Central Mex.

3. **erècta**, Lem. Branching from base and from decumbent stems, attaining 12 in. or more in height by 3 in. in diam., bright green: tubercles conical, short, upright: spines all yellow; radials 8–13; centrals 4 or less: fls. 2–2½ in. in diam. Cent. Mex.—In the groove close to the spines is often found, especially in the flowering area, a conspicuous honey gland.

4. **recurvàta**, Engelm. (*M. recurvispina*, Engelm. *M. Nogalénsis*, Runge). Stems depressed-globose and often deeply concave, 6–8 in. in diam., forming large masses 1–3 ft. in diam.: tubercles short, with usually a large gland in the groove near the apex: spines yellow or whitish, stiff, recurved-pectinate, interwoven and covering the whole plant; radials 18–20; central 1, rarely 2, recurved: fls. about 1 in. long, brownish outside. Near Nogales, Arizona, and southward in Sonora.

5. **Scheèrii**, Mühlpf. Stems ovate-globose, 3–6 in. in diam., usually simple: tubercles large and distant, deeply grooved, with 1–5 glands in the groove: spines stout, rigid, sometimes reddish; radials 6–16; centrals 1–5, stouter and longer. 1 very stout and porrect: fls. 2 in. long: seeds large for the genus. S. W. Texas and southward in Mexico.

6. **robustispina**, Engelm. (*M. Bröwnii*, Toumey). Much like the preceding, but tubercles teretish, no glands in the groove or sometimes a single one at apex: spines very stout; radials 10–15; central 1, longer, straight, curved or even hooked, rarely an additional straight upper one: fls. 2 in. long, with very slender tube: seeds large. Babuquibari mountains south of Tucson, Ariz.

7 **cornifera,** DC. Tubercles ovate, thick, rather crowded: radial spines 15–17, ashy white, 6 lines long; central 1, longer and stouter, erect, somewhat curved. Mexico.

8. **daimonocèras,** Lem. Vertex impressed, very woolly; tubercles erect-conical: spines grayish; radials 20 or more, the upper accessory ones fascicled; centrals usually 3, stronger, the 2 upper divaricate and somewhat recurved, the lower horizontal or recurved. Mexico.

9. **Echinus,** Engelm. Differs from the above in the less depressed shape and rather more numerous spines. Southern Tex. to Mex.

10. **scolymoides,** Scheidw. At length somewhat cespitose: tubercles conical, bent inwards and imbricated: radial spines 14–20, whitish or horn-colored; centrals 1–4, longer and darker, the upper mingled with the upper radials, the lower stouter and bent downwards: fls. 2 in. in diam. Mex., south of the Rio Grande.

11. **rádians,** DC. Stems simple: axils naked: tubercles oval, large: spines white, rigid, subtomentose. Mex.

12. **pectinàta,** Engelm. Stem simple: tubercles quadrangular at base, conical above; areolæ round-oblong: spines 16–24, yellowish, laterally compressed at base, stiff, pectinate, somewhat recurved: fls. 2½ in. in diam.; petals broadest above, obtusish. Pecos river and Leon Springs, Tex.

13. **impexicóma,** Lem. Vertex deeply impressed, densely woolly: tubercles somewhat angulate; areolæ round: spines 18–20, gray, rigid, covering the whole plant; very rarely a single porrect central. Mex.

14. **sulcàta,** Engelm. (*M. calcarâta,* Engelm.). Deosely cespitose from the upper part of the groove: tubercles 7–9 lines long, ovate-oblong, with dilated base, somewhat imbricate, spreading in age: spines gray, rigid, subulate; radials 12–15, the upper 3–5, fascicled; central 1, recurved, wanting in younger plants: fls. 2½ in. in expansion, the tube red within; sepals not fringed. Tex., from the Brazos to the Nueces river.

15. **Nickelsæ,** Brandg. (*M. Nickelsii,* Hort.). Very near the preceding, but radial spines more numerous, 14–18, the fascicled upper ones much longer than the lower, and no central. Mex., south of Laredo, Tex.

16. **Missouriénsis,** Sweet (*M. Nuttallii,* Engelm.). Nearly simple, 1–2 in. in diam.: tubercles cylindric-conical, loose and spreading, slightly grooved: spines white, weak, puberulent, not hiding the body; radials 12–17, spreading; central one longer and stouter, often wanting; fls. about 1 in. long, yellow to fawn-color, with reddish streak; sepals fimbriate; petals acute or acuminate: berry red, the shape and size of a small pea; seeds black and pitted. Mont. to Kans. and E. Colo.

Var. **símilis,** Engelm. Cespitose, in clumps often a foot broad: spines fewer: fl. and fr. larger. Kansas river to Texas.

Var. **robústior,** Engelm. (*M. Wissmannii,* Hildm.). Almost simple: tubercles longer and looser: spines smooth, rather short and stout; radials 10–12; central 1: fls. even larger than in *M. similis.* Tex.

17. **macromèris,** Engelm. Fig. 1355. Low, usually soon proliferous, dark green: tubercles large and long, loose and spreading, but often incurved; groove rather short; radials 10–17, weak, slender and spreading; centrals at maturity usually 4, somewhat stouter and much longer, sometimes more than 2 in. long: fls. purple, often 3 in. in expansion; petals erose, mucronate: fr. with several scales on the ovary. Along the Rio Grande from New Mexico to Texas. See, also, Fig. 746*a*.

18. **conoídea,** DC. (*M. strobiliformis,* Engelm.). Ovate-conical, with densely woolly vertex: tubercles short, usually densely appressed-imbricate in 8–10 spiral, rib-like rows: radial spines 10–16, straight and stout; centrals 3–5, stouter, blackish, the upper ones erect-spreading, the lower stouter, horizontal or deflexed: fls. about 1 in. in expansion, deep purple, paler outside: fr. short, buried and hidden in the axillary wool. N. E. Mex.

19. **vivípara,** Haw. Fig. 1356. Low and depressed globose, usually cespitose, forming large masses: tubercles terete and loose: radial spines 12–20, slender but stiff; centrals usually 4, but sometimes as many as 8, brownish, the upper erect-spreading, the lower stouter and deflexed: fls. bright purple, 1–1½ in. in expansion; stigmas mucronate. From southern Br. Am., through the upper Missouri region to E. Colo.

20. **radiósa,** Engelm. Ovate or cylindrical, sometimes proliferous: tubercles terete: radial spines 20–30, white, with dusky apex, very unequal: centrals 4 or 5, stouter and longer, tawny, upper ones longer, lowest shorter and horizontal: fls. 1½–2 in. in expansion; stigmas obtuse. Southern Tex. and northern Mex.

Var. **Neo-Mexicàna,** Engelm. (*M. Hirschtiàna,* Haage, Jun.). Lower, more or less proliferous from the lower grooves: radial spines 20–40, white; centrals 3–12, white below, blackish above.

Var. **boreàlis,** Engelm. Ovate or subglobose: radial spines 12–20; centrals 3–6, purple-spotted. Very near *M. vivipara.*

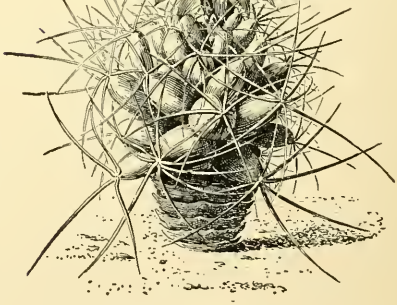
Var. **Arizónica,** Engelm. Globose or ovate, large: tubercles long-cylindrical: radial spines 15–20, whitish; centrals 3–6, deep brown above: fls. large, rose-colored. N. Arizona.

Var. **desérti,** Engelm. Low, simple, with slender nearly cylindric tubercles: radial spines 15–20; centrals 8–10, reddish tipped: fls. straw-colored, with purplish tips. Ivanpah, Calif.

Var. **chlorántha,** Engelm. Cylindrical, sometimes as much as 9 in. high: radial spines 20–25, almost in 2 series, gray; centrals 6–9, stouter, ½–1 in. long, reddish only at tip: fls. greenish yellow. S. Utah.

Var. **Álversoni,** Coulter. "Foxtail Cactus." Robust and branching, sometimes 10 in. long, glaucous: tubercles short and broad, somewhat angled, forming more or less distinct ribs: radial spines numerous; centrals 8–14, stout, spreading, blackish half-way down: fls. pink. S. E. Calif.

21. **dasyacántha,** Engelm. Simple, subglobose: tubercles terete, loose: radial spines 25–35, hair-like, white, with brownish apex; centrals 7–13, bristle-like, pale below, brown above, longer, the most interior one horizontal, sometimes wanting: seeds black, with nearly basal hilum. Tex.



*355. Mammillaria macromeris (× ½). No. 17.

22. **tuberculósa,** Engelm. (*M. strobiliformis,* Scheer). Ovate or cylindric, rather slender, somewhat dry of texture, the spines falling from the older tubercles, leaving them as dry, corky protuberances: tubercles short-ovate from a broad base; axils densely woolly: radial spines 20–30, slender, rigid, white; centrals 5–9, stouter, pur-

plish above, the upper longer, erect, the lowest horizontal or deflexed: fls. 1 in. in diam., pale purple: fr. ¾ in. long, red, with a conical cap formed of the withered remains of the flower: seeds brown. Tex.

23. **cornùta,** Hildm. Depressed-globose or hemispherical, small, grayish green: tubercles large, flattened and imbricated; areolæ round: radial spines 5–7, stout, short, compressed, radiant, grayish, the upper longer; central 1, stouter, as long as the radials: fls. rose-red. "In age the spines fall off and the plant, covered with imbricated, scale-like tubercles, reminds one of a pineapple." Mexico.

1356. Mammillaria vivipara (× ½). No. 19.

24. **elephántidens,** Lem. Rather large, glaucous green: tubercles very large and thick, becoming horizontal or deflexed and somewhat bilobed: spines 6–8, all radial, stout, yellowish or gray, appressed to the plant and somewhat recurved: fls. rose-color, 3 in. in expansion. Mexico.

25. **longimámma,** DC. Cespitose, bright green, forming large, low clumps: tubercles sometimes more than 2 inches long: spines straight, pubescent; radials 7–10; central 1: fls. 2 in. or more in expansion. Mexico.

Var. **uberiformis,** Schum. Tubercles darker green: radial spines seldom more than 4; centrals none.

Var. **globòsa,** Schum. Tubercles dark green, very long: radial spines as many as 12; centrals 2–3.

Var. **sphærica,** Engelm. Tubercles about 1 in. long. radial spines 12–14; central 1. Tex.

26. **Roseàna,** Brandg. (*M. Radliàna,* Quehl.). Upright branches 1–1½ ft. long, 1½–3 in. in diam.: tubercles rather remote, flattened and appressed, later spreading: radial spines 8; central 1, brownish, strongly hooked, 1–2 in. long, twice as long as the radials: fr. bright red, flat on the broad top and much shorter than the tubercles.

27. **setispìna,** Engelm. Upright branches 8–12 in. long, 2–4 in. in diam., forming dense clumps: tubercles rather crowded, ovate, short: spines white with black tips; radials 10–12; centrals 1–4, stouter, the lower one strongly hooked, often twisted, 1½–2 in. long, 2 or 3 times as long as the radials: fr. red, much exceeding the tubercles.

28. **Pòndii,** Greene. Upright branches 10–15 in. long, 1½–2 in. in diam., making much smaller clumps than the two preceding: tubercles short, ovate, not crowded; axils setose: spines in three series, outer 15–25, short, white; inner 5–8, brown, longer; central row 3, brown, usually 2 of them strongly hooked, 1 in. or more in length, much exceeding the other spines: fr. oval or obovate, dull purplish red, ¾ in. long.

29. **Hàlei,** Brandg. Upright branches 1½–2 ft. high, 2–3 in. in diam.: tubercles rather crowded, short-conical from a broad base: spines sub-3-serrate, outer 15–25; centrals 6–9, darker, the lower one much stouter, an inch or more long, usually straight but sometimes hooked, twice as long as the other spines: fr. obovate, red.

30. **elongàta,** DC. (*M. dénsa,* Link & Otto). Erect, 6–7 in. long, 1–1½ in. thick: radial spines 16–18, yellow; centrals none: fls. white or yellowish. Central Mex.

Var. **echinàta,** Schum. (*M. echinàta* and *M. echinaria,* DC.). Radials as many as 20, yellow; centrals 2–3, brown.—A stout form.

Var. **ténuis,** Schum. (*M. ténuis,* DC. *M. minima,* Salm.) Radial spines about 20, pale yellow; centrals none—The most slender form, only ½ in. thick.

Var. **stèlla-auràta,** Schum. Stems somewhat thicker: spines golden yellow; 1 central usually present.

31. **Leòna,** Pos. Stems stouter, glaucous, upper axils woolly: radial spines about 30, radiant, slender, white; centrals 6–12, much stouter; the upper ones longest, ivory white at base, dove-color or bluish above. Nuevo Leon, Mex.

32. **decipiens,** Scheidw. (*M. Guilleminiàna,* Lem.). Irregularly cespitose, somewhat clavate, often rosy: tubercles cylindrical; axils sparingly bristly: radial spines 7–12, whitish; centrals 1–2, brown, longer; all slender. Mex.

33. **frágilis,** Salm. Stems low, usually as broad or broader than high, extremely proliferous, the offsets so lightly attached that they soon fall by their own weight: radial spines 12–14, white; centrals none or 1, rarely 2, white, with dusky tip. Mex.

34. **lasiacántha,** Engelm. Low, usually globose or depressed-globose: tubercles slender, axils naked: radial spines as many as 40–80, feathery; centrals none. Tex.

Var. **denudàta,** Engelm. (*M. Rúngei,* Hort.). Larger, both plant and tubercles: spines naked. Cact.

35. **plumòsa,** Web. Densely cespitose, at length forming masses 6–10 in. in diameter; axils long-hairy: radical spines about 40, feathered to the tip; centrals none.—This and the preceding are like feathery balls. *M. plumosa* is sold usually under the name of *M. lasiacantha,* to which it appears to be rather closely related. North Mex.

36. **senilis,** Salm. "Proliferous at base: axils not setose: tubercles crowded: spines all white; exterior very numerous, erect-spreading, hair-like, flexuous; centrals 4–6, a little stronger, the upper and lower hooked." Chihuahua, Mex.

37. **barbàta,** Engelm. Globose-depressed: axils not setose: exterior spines very numerous, pilose; interior stronger, yellowish, 10–15; central solitary, stout-hooked, yellowish, not much longer than the others: fls. small, not remote from the center; sepals fimbriate: berry "green." Near Chihuahua, Mex.

38. **vètula,** Mart. Subglobose or becoming subcylindrical: axils not setose: radial spines bristle-like, at first 25–30, obliquely spreading, later twice as many and horizontal; centrals 1–3, yellowish brown, scarcely stouter or longer. Mex.

39. **cándida,** Scheidw. (*M. sphærótricha,* Lem.). At length cespitose, globose, becoming longer: vertex depressed: axils setose: radial spines bristle-like, more than 50, horizontal and interwoven; inner spines 8, 10, 12, or more, a little stouter and upright: fls. flesh-color or pinkish.

40. **pusilla,** DC. (*Cáctus stellàtus,* Willd. *M. stellàris,* Haw.). Low, globular, proliferous, making large masses: tubercles cylindrical, small and loosely spreading; axils with long, hair-like, tortuous bristles: radial spines 12–20, very soft and flexuous; centrals 4–6, yellowish, a little rigid, pubescent: fls. yellowish white. W. Indies.

Var. **múlticeps,** Salm. Larger: tubercles upright, crowded: radial spines numerous; centrals 6–8, slender, pubescent, reddish yellow. Mex.

Var. **Texàna**, Engelm. Larger than the last: spines in 3 series; outer capillary, crisped, 30–50; interior 10–12, a little more rigid, pubescent, white; centrals 5–8, longer, stouter, pubescent, yellow at tip. Tex. and adjacent Mex. Cact.

41. **Bocasàna**, Pos. Depressed-globose, or a little lengthened, at length densely cespitose: axillary bristles as long or longer than the tubercles: radial spines 25–30, white, stiff at the base, ending in a flexuous thread; centrals 2–3, slender, porrect, short, all yellow with brown tips, the hooked one brown nearly to the base, pubescent. Mex.

42. **Wildii**, Dietr. (*M. Wildiàna*, Otto). Cespitose, forming hemispherical clumps: radial spines 8–10, very slender, white, spreading; centrals usually 3–4, a little stouter and longer, honey-yellow, brown at base, pubescent, 1-hooked. Mex.

43. **tetrancistra**, Engelm. (*M. pluriospérma*, Engelm.). Ovate or ovate-cylindrical, rather large, simple or sparingly branched from the base: young axils sparingly setose: radial spines 30–60, in two series; exterior bristle-like, white; interior stouter and longer, dusky-tipped or purplish; centrals 1–4, longer, brown or blackish, sometimes all hooked, the upper ones sometimes straight: seed partly immersed in a brown corky cup. S. Calif. to Utah. Cact.

44. **dioica**, Brandg. (*M. Goödrichii*, of California). Simple or cespitose from the base, ovate to cylindrical, 3–8 in. high: tubercles somewhat angular and leathery: radial spines 11–22, white, with brown or purple tips; centrals 1–4, longer and darker, the upper turned up among the radials, the lower porrect and strongly hooked: fls. often unisexual, yellowish white with rosy streak. Calif. and Lower Calif.

Var. **insularis**, Brandg. (*M. Pálmeri*, Coult., not of Jac.). Stems densely cespitose, shorter: axils densely woolly: spines much whiter, usually all straight. San Benito Island.

45. **armillata**, Brandg. Taller, often 1 ft. in height, branching at base and along the stem: tubercles crowded: radial spines 9–15; centrals 1–4, nearly twice as long: fls. small, yellowish, scarcely spreading. Lower Calif.—The plant is marked by darker circular bands.

46. **Wrightii**, Engelm. Globose or depressed, top-shaped below: radial spines 8–12, white, pubescent; centrals 1–3, reddish black, scarcely longer than radials, all hooked; fls. about 1 in. long, purple. New Mexico.

47. **Goödrichii**, Scheer. Erect, cylindrical, branching at base; axils naked: radial spines about 12, white; centrals 4, white below, brown above, the 3 upper erect-spreading, the lower longer. Cedros Island and Lower California.

48. **Gràhami**, Engelm. Globose or ovate, somewhat cespitose: radial spines 15–30, white, often dusky at tip, the upper ones shorter; centrals usually 4, usually blackish from a paler base, the 3 upper turned up among the radials, and, when pale, hardly to be distinguished from them; lower porrect: fls. rose-colored, 1 in. in expansion: fr. nearly 1 in. long. From Texas to S. California and adjacent Mexico.

49. **venusta**, Brandg. Globose or hemispherical, small, often cespitose: tubercles very thick and blunt, concave at the end, usually extremely glaucous: radial spines 9–15, stout, from pure white to white below and brownish above; central commonly 1, sometimes 2 or 3, the lower little longer and darker than the radials: fls. rose-color, 1½ in. in expansion: fr. scarcely juicy, nearly 1 in. long, circumscissile near the base. So. Lower California.

50. **Maïnæ**, Brandg. Hemispherical to ovate, usually simple: tubercles somewhat incurved, glaucous, the lower part and the axils often bright rose-red: radial spines 10–15, yellowish becoming gray, the upper shorter; centrals 1–3, the upper shorter and smaller, turned upward, one of them sometimes hooked, lower central stout, strongly hooked, somewhat twisted, yellowish below, black at tip: fls. flesh-color: fr. shorter than the tubercles. Vicinity of Nogales, Arizona.—Sent out as *M. Galeottii*.

51. **Cárretti**, Schum. Simple, depressed-globose, rather small: radial spines spreading-recurved and interwoven, rather long, yellowish; central 1, slender, chestnut-brown, paler below: fl. whitish, with rosy streak in petals; sepals long-acuminate. Mex.—The only specimen seen has bristles in the axils.

52. **eriacántha**, Link and Otto. Cylindrical, elongated, ½ ft. and more in height ("reaching 20 inches") by 2–2½ in. in diam.: tubercles crowded, acutely conical: spines all pubescent; radials 20–24, pale yellow, bristle-like; centrals 2, stronger, nearly twice as long as the radials, golden yellow, one directed, the other downwards: fls. yellow, small: fr. yellow. Mex.

53. **sphacelàta**. Stems cespitose, cylindrical, 6 in. or more long, 1 in. in diam.: tubercles short, conical from a broader, rhombic base: spines ivory white with blackish tips; radials 12–18, horizontal-spreading; centrals 3–4, upright: fls. small, the petals acute. Mex.—The proper position of this and of the preceding species is still quite uncertain.

54. **spinosissima**, Lem. Stems cylindrical, reaching 1 ft. in height and 2½ in. in diam.: tubercles short, ovate-conic, somewhat tetragonal: radial spines 20–25, setiform, white, spreading; centrals 12–15, brownish red, stronger and twice the length of the radials. Mex.

Var. **sanguínea**, Hge. Stem somewhat clavate, rather shorter and stouter: radial spines 18–20, spreading, white; centrals 8, only a little longer, but thicker and bulbous at base, white with brownish base and dark brown tip, the young ones dark blood-red. Mex.

55. **rhodántha**, Link and Otto (*M. Odieriàna*, Lem. *M. fulvispina*, Haw.). Stem long-cylindric or elavate, reaching more than 1 ft. in height, usually 2-parted: axils bristly: radial spines 16–20, white, bristle-like, horizontal-spreading; centrals 4–6, rigid, white or yellowish, the upper black at tip. Mex.

Var. **pyramidàlis**, Schum. Central spines dark brown, the young ones ruby red.

Var. **Pfeiffèri**, Schum. (*M. aurèiceps*, Lem.). Radial spines 25 or more, yellow; centrals 6–7, recurved spreading, golden brown.

Var. **crassispina**, Schum. Radial spines 24–27, whitish: centrals 6–7, larger and stouter, more curved darker.

Var. **fuscàta**, Schum. Axils naked; tubercles 4-angular at base: radial spines 25–28, radiant, bright yellowish brown: centrals 6, stout, strongly curved, the upper very long.

56. **dolichocéntra**, Lem. (*M. tetracántha*, Hook.). Subglobose (but said to reach a yard in height): tubercles somewhat 4-angled; areolæ elliptic or rhombic: radial spines none; centrals 4, slender, rigid, the upper curved upward, 1–1½ in. long, the three lower half as long, all grayish brown. Mex.

Var. **Galeóttii**, Först. Radial bristles 8–14, very short, soon falling; centrals 4, seldom 1 or 2 more, spreading, yellowish, with points, the upper and lower longest. Mex.

57. **discolor**, Haw. Globose or ovate, glaucous: outer spines 16–20, white, radiant; interior 6, rigid, recurved, white below, black above, upper and lowermost very long. Mex.

58. **Lesauniéri**, Schum. Hemispherical or very short-cylindrical (habit of *M. Heyderi*): spines brownish, short; radials 11–13; central upright, stronger.

59. **Haageàna**, Pfr. Cespitose: heads small, at length cylindrical, slender: tubercles small, crowded; axils woolly: radial spines about 20, pure white, only about 1½ lines long; centrals 2, black, slender, elongated, upper 3, lower 4 lines long. Mex.

60. **élegans**, DC. (*M. acanthophlégma*, Lehm. *M. Potosìna*, Hort. *M. Klàgii*, Ehrh.). Simple, then proliferous and densely cespitose, depressed-globose, later lengthened: tubercles crowded, very small: radial spines more than 20, bristle-like, about 3 lines long, pure white, interwoven and covering the whole plant; central spines 2 (1–3), with brown tips, the one directed upward, the other downward, about twice as long as radials, in the axils abundant long white wool. Mex.

61. **bicolor,** Lehm. Simple or proliferous: tubercles small, crowded, ovate-pyramidal: radial spines 16–20; centrals 2, less than 1 in. long, stouter, erect, black-tipped. Mex.

Var. **nivea,** Schum. Obovate proliferous tubercles conical: radial spines capillary; centrals 4, white, with dusky apex, upper one incurved, 1 in. long.

62. **Párkinsonii,** Ehrh. At length dichotomously divided: tubercles slenderly pyramidal; axils woolly and bristly: radial spines 20 or more, slender; centrals 2, 3, 4, rarely 5, brown-tipped, the upper ones 3–4 lines long, the lower 1½ in. turned downward. Mex.

63. **formòsa,** Scheidw. Nearly simple: tubercles 4-angled: radial spines 18–22, rather rigid; centrals 6, a little longer, stiffer, thickened at base, reddish or brownish tipped.

64. **angulàris,** Link & Otto (*M. subangulàris*, DC.). Densely cespitose: axils of the young tubercles setose as well as woolly: radial spines 3–7, the upper ones often very short, the lower one sometimes 3 in. long, occasionally a very long central present. Mex.

65. **centricirrha,** Lem. (*M. arietina* and *deflexispina*, Lem. *M. Förstcri* and *Krämeri*, Mühlpf. *M. Schmidtii*, Seke. *M. tetracántha*, Hort.). Copiously proliferous: tubercles pyramidal, 4-angular: spines irregular, mostly 4–6 radials and 1 central, sometimes only 1, sometimes 2 centrals with 1–2 very short radials or none; radials very stout, straight or curved, awl-shaped, reaching ¾ in.; central stouter, sometimes nearly 2 in. long; young spines yellow. Mex.

66. **mutábilis,** Scheidw. (*M. autumnàlis*, Dietr. *M. cirrhifera*, Mart.). At length sparingly cespetose, depressed-globose or short-cylindric: tubercles pyramidal, 4-angled: axils with stout bristles in the wool: radial spines 1–6, very small; centrals 1–4, angled, flexuous, much longer, particularly the upper one, which reaches 2 in. Mex.

67. **Heeseàna,** McDow. (*M. Pètersonii*, Hildm.). Simple, glaucous or ashy green: tubercles pyramidal, 4-angled: radial spines 10–14, the three upper pure white and very short, the remainder longer and brownish-tipped; centrals 4, the upper ones erect and forming an elevated covering for the top of the plant, the lower one the longest, 2 in. long and projecting. Mex.—Varies in color of spines.

68. **simplex,** Haw. Globose or short-cylindric: radial spines 12–17, the middle ones longest; centrals 4–5, somewhat longer, reddish to black: flower brownish green without, yellowish or whitish green within: fr. red, ⅜ in. long, clavate; seed "black." Cuba.

69. **Brándegei,** Coult. (*M. Gábbii*, Coult.). Depressed-globose to short-cylindric or clavate: tubercles slender: radial spines 9–16; centrals 1–4, sometimes shorter than the radials, and stout, sometimes longer and slender, white to brown: fls. reddish brown without, brownish green within: fr. clavate, white, tinged lilac. Central lower Calif.

70. **Heyderi,** Muhlpf. (*M. Terénsis*, Lab.). Tubercles slender: spines short: radials 16–18, short, slender, white; central 1, darker, shorter than the lower radials, brown: fls. yellowish, with pale rosy streak in the petals. Arizona to Texas.

Var. **applanàta,** Engelm. Body much depressed, summit flat or concave: radial spines 15–22. Texas.

Var. **hemisphærica,** Engelm. Top rounded, radial spines 9–12. N. E. Mex.

71. **meiacántha,** Engelm. Fig. 1357. Usually simple: tubercles rather large, sharply angled and 4-sided, pyramidal: radial spines 5–9, mostly 6, white or yellowish; central 1, rarely a second, shorter and darker than the radials: fls. whitish, with reddish streak. Tex.

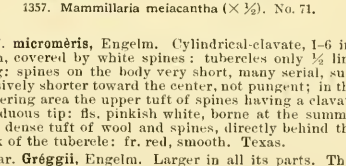
72. **cárnea,** Zucc. Body dark green: tubercles rather large, pyramidal, 4-angled: radial usually none, rarely 1–2; centrals commonly 4, in upright cross, stiff, grayish, with darker tip, in young growth dark brown or reddish: fls. reddish flesh-color. Mex.

73. **uncinàta,** Zucc. Depressed-globose to subclavate: tubercles pyramidal, not strongly angled: radial spines 4–6, short, gray, dark-tipped; centrals 1, rarely more, longer and stronger, strongly hooked, dark. Mex.

74. **Trohártii,** Schum. Globose or depressed, small: tubercles very small, conical, scarcely angled: radial spines 5, white with dark brown tips, the lower longest; central 1, dark brown, stiff. Mex.

75. **sempérvivi,** DC. Globose, blackish green, axils woolly: tubercles short, angled: radial spines 3–7, very short, only found on young tubercles; centrals only about 2 lines long, stout, conical, reddish, later gray: fls. dull white with reddish streak. Mex.

76. **Caput-Medùsæ,** Otto. Depressed-globose, dull, glaucous green, small: tubercles slender, angled at base: spines 3–6, very short, subulate, straight, reddish when young, later gray, pubescent: fls. whitish, red-streaked. Mexico. Monog. Cact. fig. 95.



1357. Mammillaria meiacantha (× ½). No. 71.

77. **micromèris,** Engelm. Cylindrical-clavate, 1–6 in. high, covered by white spines: tubercles only ½ line long: spines on the body very short, many serial, successively shorter toward the center, not pungent; in the flowering area the upper tuft of spines having a clavate deciduous tip: fls. pinkish white, borne at the summit in a dense tuft of wool and spines, directly behind the apex of the tubercle: fr. red, smooth. Texas.

Var. **Gréggii,** Engelm. Larger in all its parts. This plant is not a Mammillaria, and has been recently named *Echinocactus micromeris*, Web.

Mammillarias, in common with other Cacti, run into many forms. Some of these forms may be valuable to the horticulturist, and yet not sufficiently distinct to warrant the giving of definite botanical names. The following names, not accounted for in the above review, are offered in the catalogues of American dealers: *M. Brandi.*—*M. bruuca.*—*M. cirrhifera longispina* (see No. 66).—*M. Donati.*—*M. filipendula.*—*M. fuscata leona* (see Nos. 55, 31).—*M. Lassomeri*=M. Lesaunieri (?).—*M. melanacantha* is an uncertain garden name.—*M. montana.*—*M. Nicholsoni*=M. Nickelsæ (?).—*M. Rebsamiana.*—*M. recurvens.*—*M. rigidispina.*

KATHARINE BRANDEGEE.

MANDARIN ORANGE. See *Citrus nobilis*.

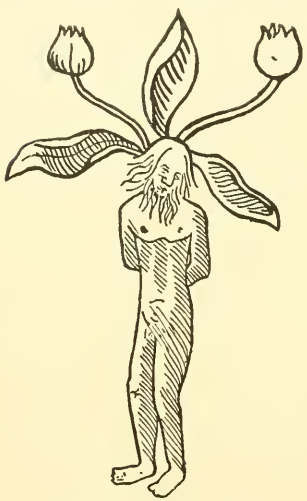
MANDEVÍLLA (Henry John Mandeville, English minister at Buenos Ayres). *Apocynàceæ*. About 40 species of tall climbers from tropical America with large, funnel-shaped, 5-lobed fls. which are yellow, white or rarely tinged violet. *M. suaveolens* has fragraut white fls. and is cult. outdoors in S. Calif. Seeds are also procurable in the East. The plant closely resembles Dipladenia, which see for culture.

Generic characters: lvs. opposite: racemes simple, often 1-seeded, loose, dense or reduced to 2 or 3 fls.; calyx 5-parted, with several glands inside at the base or 5 scales; corolla tube cylindrical or ovoid; lobes 5, broad, twisted to the left; stamens fixed at the apex of the tube, included; disk of 5 lobes or scales: ovary of 2 distinct carpels: stigma thick.

suavèolens, Lindl. Sometimes called Chilean Jasmine because of its climbing habit and large white fragrant fls. Lvs. cordate, stalked, glabrous above, glaucous beneath; stipules pectinate: racemes with about 9 fls.

each 2 in. across. Argentine Rep. B.R. 26:7. B.M. 3797. Gn. 29, p. 537. G.C. III. 2:817. P.M. 16:289. R.H. 1845:167.—Characterized by a pale, fleshy pectinate ring between the base of the calyx and corolla. W. M.

MANDRÁGORA (name used by Hippocrates; referring to its growing near stables in the market places). *Solanàceæ*. A genus of 3 species, one of which is supposed to be the Mandrake mentioned in Genesis, chap. 30. In America the name Mandrake is applied to the May-apple, *Podophyllum peltatum*, but the Mandrake of history was a plant with a large spindle-shaped root which was supposed sometimes to become forked and resemble the human form. In this condition it was used as an aphrodisiac. The plant was also called Love-apple, and many superstitions about it still survive. The old herbals abound in fanciful pictures of the Mandrake, one of which is reproduced in Fig. 1358. *M. officinarum* is sold in America and may be cult. in the hardy border for its folk-lore interest. *M. autumnalis* is supposed by some to be the true Mandrake. Both are natives of the Mediterranean region. *M. caulescens* is found in the Himalayas.



1358. Mandrake.
From an old herbal (see *Mandragora*).

Mandragoras are nearly stemless, perennial herbs with thick roots and large, stalked, wavy-margined lvs., the later ones being usually narrower and entire, and rather large fls. varying from whitish through bluish violet and purplish shades. The fls. are bell-shaped, about 5-cut, netted-veined and borne in clusters among the tufted lvs. Calyx deeply 5-cut; sinus of the corolla induplicate between the lobes.

officinàrum, Linn. (*M. officinàlis*, Mill.). MANDRAKE. Lvs. ovate, the first obtuse, the rest acuminate: calyx teeth lanceolate, as long as the oblong berry. Woolson says it needs a shady place. R.H. 1897, p. 131. W. M.

MANDRAKE in America means the May-Apple (Podophyllum) but the Mandrake of history is *Mandragora*.

MANÉTTIA (Xavier Manetti, of the botanic garden at Florence, born 1723). *Rubiàceæ*. This includes the common Manettia Vine, *M. bicolor*, which has scarlet, tubular fls. an inch or more long, with 5 spreading yellow tips. It is a twining plant, and is often trained to pillars and trellises both indoors and out, as it blooms more or less the year round. It can also be trained into a bushy form. By Index Kewensis *M. bicolor* is referred *M. luteo-rubra*, although the former is the older name. William Watson writes of *M. bicolor* (Gn. 56, p. 6): "It has been in cultivation about fifty years, but until recently it was practically lost, and its place and name taken by a much inferior species, the correct name of which is *M. luteo-rubra*. I believe we are indebted to Mr. Godseff for the recovery of the true plant, he having found it in cultivation in the United States a few years ago." Apparently the chief recorded difference between these two species is that the calyx-lobes of *M. bicolor* are lanceolate or narrower, while those of *M. luteo-rubra* are ovate.

The Manettia Vine is a rather old-fashioned plant, and generally easy of culture. It is fairly satisfactory as a cool conservatory vine, but is an easy prey to red spider and mealy bug. The fls. are short-lived, and not the best for cutting. Some gardeners would rather have Cupheas or *Jacobinia Pohrhosiensis*. Manettias are prop. by cuttings of young growth inserted in sand with bottom heat. For summer use the vines should have a sheltered but sunny position.

Manettia is a genus of about 30 species of twining herbs and slender subshrubs from tropical and subtropical America. Glabrous or villous: lvs. usually long-acuminate: fls. small or rather large, axillary, solitary or in short corymbs or panicles, white, blue or red; calyx-lobes 4, rarely 5, short or long, narrow or broad; corolla tube short or long, terete or angled, straight or curved, glabrous or pilose within; stamens 4. "*Matsea glabra* or Manettia" is advertised in Amer., but no Matsea appears in botanical treatises.

A. *Fls. red, tipped yellow.*

B. *Calyx-lobes lanceolate, narrow.*

bicolor, Paxt. Fig. 1359. Lvs. lanceolate acute, slightly glaucous: calyx of 4 or 8 reflexed lobes. Mts. near Rio Janiero. P. M. Vol. x. 27. Gn. 56:1229. F.S. 2:69. R.B. 21:49. Gt. 47, p. 214.—*Manettia bicolor* is easy to grow, but it is short-lived and consequently must be renewed often. Well-trained specimens are very pretty.

1359. Manettia bicolor (×⅓).

BB. *Calyx-lobes ovate-acuminate, leafy.*

lùteo-rùbra, Benth. Pubescent: lvs. ovate or oblong, acute, narrowed at the base, tomentose beneath: pedicels solitary: calyx not toothed in the sinuses: corolla tomentose outside, equally tubular, straight. Brazil.—The above is a full translation of the original description.

AA. *Fls. red.*

cordifòlia, Mart. (*M. cordàta*, Hort.). Lvs. ovate, cordate at base, finely pubescent on both sides: peduncles axillary, 1-fld. Brazil. B.R. 22:1866. B.M. 3202.—Cult. outdoors in Fla. and Calif., and makes a fine subject for planting out in the North. W. M.

MANFRÈDA. See *Agave*.

MANGEL-WURZEL. A race of beets with very large roots, grown for fodder. Often called *Beta vulgaris*, var. *macrorhiza*.

MANGÍFERA (Latin, *mango-bearing*; Mango being the Hindoo name of the fruit). *Anacardiàceæ*. A genus of 27 species of tropical Asian trees, of which *M. Indica*,

the Mango, is cult. everywhere in the tropics. The fruit (Fig. 1360) is large (4–5 in. long) and kidney-shaped, the skin being smooth, rather soft, pale green, yellow or half-red, and resinous. Inside is a large seed nearly as long as the fruit. The shell of the seed is rough and fibrous; the kernel is shaped like a bean and is sometimes roasted and eaten like chestnuts. In a poor variety of Mango the pulp is so full of fiber that the fruit is sucked rather than eaten, and beginners say it tastes like a ball of cotton soaked in turpentine and molasses. This is particularly true of the common or turpentine variety, but the improved kinds are not unpleasantly fibrous. There are said to be 130 or more varieties cult. in India, where the Mango is most esteemed. All parts of the Mango tree have a sweet, resinous fragrance which suggests turpentine.

In the tropics the Mango is a staple article of food during the hot months. The ripe fruits are eaten raw, either plain or sliced with wine, sugar and nutmeg. The unripe fruits are made into jellies, preserves, tarts and pickles. Starch and glucose are also made from Mangoes. A wine is made by adding vinegar to the juice of Mangoes. Various domestic animals are also fond of the fruit. As to quality, the Mango is ranked by some next to the finest pineapples and the mangosteen.

The Mango is extensively cultivated in the West Indies, and slightly in S. Fla. and S. Calif. A sketch of its history in Florida is found in Bulletin 1, Div. of Pomology, U. S. Dept. of Agric., from which the following facts are taken: No fruit stood higher in the popular esteem in parts of south Florida than the Mango at the time when the disastrous freeze of January, 1886, killed to the ground every or almost every tree north of Fort Myers. In 1884, 125,000 fruits were shipped from Jamaica to the United States, and brought $900. In their eighth year from seed two Florida trees bore 19,000 fruits. Some of these fruits weighed a pound. In all cases where the trees were well cared for they produced from 4,000 to 9,000 Mangoes each when once well in bearing. Mangoes were shipped to Chicago and brought 60 cents a dozen. The fruit ripens June–Sept. The only varieties advertised in America in 1899 were the Common or Turpentine, Cole, Black, Long, No. 11, Apricot and Apple. The following have been advertised in the past: Alphonse, Banchore, Devambria, Green Mexican, Melachoton, Pirie, Yam. The Mango can be fruited under glass in the North. It requires a winter temperature of 60°.

The Mango tree is evergreen, grows 30–40 ft. high and makes a round, dense top (see Fig. 1361). The fls. are small and produced in terminal pyramidal panicles. A greenhouse specimen in England is said to have borne 108 panicles, each containing 2,100 fls., or a total of a quarter of a million fls. The Mango is a native of the East Indies. W. M.

1360. Mangifera Indica.

Mangoes in Jamaica.—The Mango was first known in the New World in Brazil, whence it was brought to Barbadoes in the middle of the eighteenth century. In 1782 a French vessel on its way to Haiti was captured by one of Rodney's squadron and brought as a prize to Jamaica; the collection of economic plants on board was deposited in the Botanic Garden. Many of the plants were new to the island, and amongst these was the Mango. It is said that the book containing the local names of the fruits was thrown overboard. The plants were numbered, and Nos. 11 and 32 have become famous varieties in the West Indies. The colored plate in the Botanical Magazine (4510) is supposed to represent No. 32.

1361. Mangifera Indica.

In Jamaica it has become thoroughly naturalized and one of the commonest trees. In wet districts it is liable to cease fruiting after a few years, probably on account of its vigorous growth. It is recommended to treat it as one would other fruit trees in temperate climates in similar circumstances. Propagation is effected either by sowing the seed of good varieties or grafting from a good variety on strong seedlings. The fruit on trees grown from seed is not true to the parent in every case, but the percentage is so large that this has been the usual method employed. The kind of grafting employed is that known as grafting by approach or inarching. Any kind of soil suits it. WM. FAWCETT.

Mangoes in Florida.—The Mango deserves to be planted on well-protected land all over south Florida. The best soil is high, well-drained, sandy land suitable for oranges, but the Mango thrives also on black-jack, scrub and spruce-pine lands, where most other trees are a failure. Any good fertilizer will make the Mango grow, but for fruit use plenty of ashes or sulfate of potash beside the usual manure. In case of a hard freeze cut the trunk back at once to sound, live wood. The Mango tree is very handsome. The young growths are wine-colored. E. N. REASONER.

Mangifera is a genus of 27 species according to the latest monographer, Engler in DC. Mon. Phan. 4: 195 (1883). They are all tropical Asian trees, their nearest ally of horticultural value being the Cashew, which is fully described under Anacardium. Lvs. alternate, stalked, leathery, entire: fls. polygamo-dioecious; calyx 4–5-parted; petals 4–5, overlapping, the middle nerve usually thickened; fertile stamens 1, or 4–5: style filiform.

Indica, Linn MANGO. Figs. 1360–1. Lvs. thickish, 6–10 in. long, with about 15 pairs of lateral nerves: panicle longer than the lvs., densely covered with short, yellowish hairs: disk tumid (not minute), 4–5-lobed, wider

than the ovary; petals inserted at the base of the disk, 5, rarely 4, with 1–5 veins, which are prominent on the upper side but scarcely so at the apex; fertile stamens 1–2, inserted at the base of the disk. B. M. 4510.

W. M.

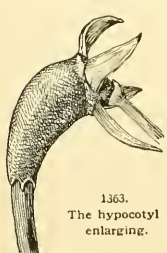
MANGO. Consult *Mangifera.*

MANGOSTEEN. *Garcinia Mangostana.*

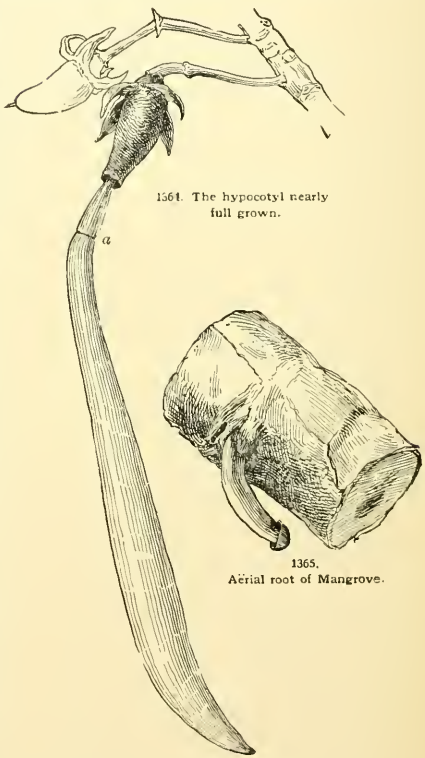
1362. The beginning of germination in the Mangrove.

MANGROVE (probably an altered Malayan name) is a name applied to species of Rhizophora (Greek, *root-bearing*). The Rhizophoras are perhaps 5 or 6 in number, and are widely distributed on tropical shores. The genus gives name to the family *Rhizophoraceæ*, which Bentham & Hooker place in close relation to the *Combretaceæ* and *Myrtaceæ*. The common Mangrove, *R. Mangle*, Linn., is one of the commonest plants on the swampy shores of tropical and subtropical seas. It is not in cultivation, but its strange methods of propagation make it one of the most interesting of plants. The following account is reprinted from Bailey's "Lessons with Plants:"

The Mangrove grows on the low shores of tropical lands. It extends as far north as the twenty-ninth parallel in Florida, and occurs at the mouth of the Mississippi and on the coast of Texas. It is a spreading bush, reaching a height of 15 to 25 feet upon the shores, but becoming a tall tree in various places. It is an important agent in the extension of land into the sea. The means by which this result is accomplished are two. The fruit is small and capsule-like, but does not fall from the tree at maturity. A fruit is shown natural size in Fig. 1362. The seed is germinating, sending its caulicle out through the apex of the fruit. In Fig. 1363 the germination is further progressed. In Fig. 1364, germination is nearly completed. The seed has endosperm. The cotyledons do not unfold in germination, but a woody tube grows from them and projects from the fruit to the point *a*. Inside this tube is the plumule. The hypocotyl continues to elongate, becoming thick and heavy at its lower end. When 6 inches or a foot long, it breaks away from the joint *a*, carrying the liberated plumule with it, and strikes root-end down in the mud. Roots push out from the lower end, and the epicotyl rapidly elongates and rears itself above the water. A piece of a Mangrove branch is shown natural size in Fig. 1365. An aërial root is pushing through the thick bark. The root makes a strong curve when it strikes off the branch, and then grows directly downward towards the water. The branch from which it springs may be only a few inches above the water, or it may be 10 feet; but the root pushes on until it inserts itself in the mud, and there makes a root system of its own. These long, lithe, descending roots (Fig. 1366), swaying in the wind, are characteristic features of the Mangrove swamp. Usually the hanging roots are unbranched, but now and then the tip breaks up into short branches (Fig 1367) before it reaches the water. These long roots remain attached at the upper end, and become trunks. The Mangrove plantation, therefore, becomes an interwoven mass, and thus marches on into the tidal rivers and the ocean, catching the flotsam and jetsam of the sea; and thereby it builds land and extends the shores. In the quiet recesses of the Mangrove swamp aquatic and amphibious life finds refuge. The shell-fish cling to the trunks and at low tide they are exposed, thus giving rise to the stories of the early explorers that oysters grow on trees. All this will recall the accounts of the banyan tree, and there are wild fig trees (the banyan is a fig) in Florida and southward which behave in a similar way. It seems strange that roots should strike out into the air, but the reader may have observed the "brace roots" near the ground on Indian corn; and many plants, as the ivy and trumpet-creeper, climb by means of roots.



1363. The hypocotyl enlarging.



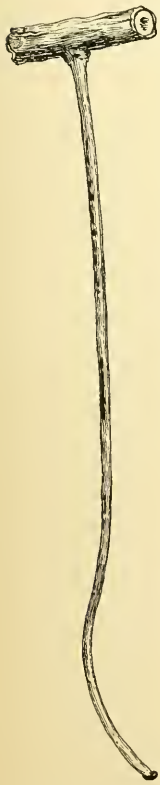
1364. The hypocotyl nearly full grown.

1365. Aërial root of Mangrove.

MANIHOT (native Brazilian name). *Euphorbiàceæ.* About 80 species of perennial herbs or shrubs, with milky juice, occurring in tropical America, mostly in Brazil. Nearly always smooth and blue-green colored: lvs. alternate, entire or palmately lobed or divided: fls. large for the order, racemose or paniculate, terminal or axillary, monœcious; calyx imbricate in the bud, campanulate or radiate, often petal-like, 5-lobed; petals none; stamens few, in 2 whorls in the angles of the disk: capsules 3-celled, 3-seeded. Not much grown in greenhouses, except in forms of *M. palmata*. The economic species may do well in the tropical parts of the United States, where they are being introduced. According to Nicholson, they are best grown in peat loam and sand, and propagated by cuttings of young, rather

fine shoots, rooted under a bell-glass in sandy peat, with bottom heat. The first species is grown in Florida, and all are procurable from southern California. The cultivation of Cassava is now attracting much attention in Florida.

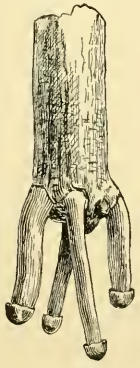
Glaziòvii, Müll. Arg. CEARA RUBBER TREE. Lvs. long-petioled, peltate, deeply 3–5-palmately parted, or the upper entire; divisions entire, broad, ovate-lanceolate: fls. paniculate: bracts small. Brazil; extensively grown in Ceylon and India.—Its juice gives the Ceara rubber.



1366. The descending root.

utilissima, Pohl. CASSAVA, or MANIOC PLANT. BITTER CASSAVA. Figs. 1368–69. Roots fleshy, cylindrical, sometimes weighing as much as 30 pounds, and 3 ft. long, very poisonous: stems knotty, about 3 ft. high: lvs. long-petioled, not peltate, deeply 3–7-lobed; lobes lanceolate, entire: bracts small, entire: calyx glabrous outside, puberulent within, yellowish, 5-parted: filaments glabrous; anthers short: capsule and ovary distinctly wing-angled. July. Brazil. B.M. 3071.—Cultivated extensively in the tropics, where the Cassava made from the roots is a staple food. Tapioca is made from the root-starch by drying it in pellets on heated plates. The poisonous juice is pressed out in preparation or rendered harmless by heating.

palmàta, var. **Aipi,** Müll. Arg. (*M. Aipi,* Pohl). SWEET CASSAVA. Closely related to the last, but the root more red-



1367. Multiple tips of a Mangrove root-branch.

dish colored and non-poisonous; anthers elongated: capsule only angular above, not winged. Brazil.—Used as the last, but not so extensively.

J. B. S. NORTON.

The cultivation of Cassava is of the simplest description in the West Indies. A piece of the stem, 2 or 3 feet long, is planted in somewhat sandy ground and left to its fate, with occasional hoeing of weeds. In suitable soils in the driest parts of Jamaica, it produces enormous crops with little or no attention.

Ceara Rubber has not been cultivated in the West Indies to any extent, but it is like Cassava in its capability of growing in dry, sandy soil. It would probably yield more rubber if grown in districts where irrigation is possible.

WM. FAWCETT.

MANITOBA. See *Canada.*

MANNA. See *Alhagi.*

MANNING, ROBERT (July 18, 1784, to Oct. 10, 1842), was one of the most thorough and accurate of American descriptive pomologists. In 1823 he established his "Pomological Garden" at Salem, Mass., for the purpose

1368. Flowers and fruit of Manihot utilissima. Enlarged.

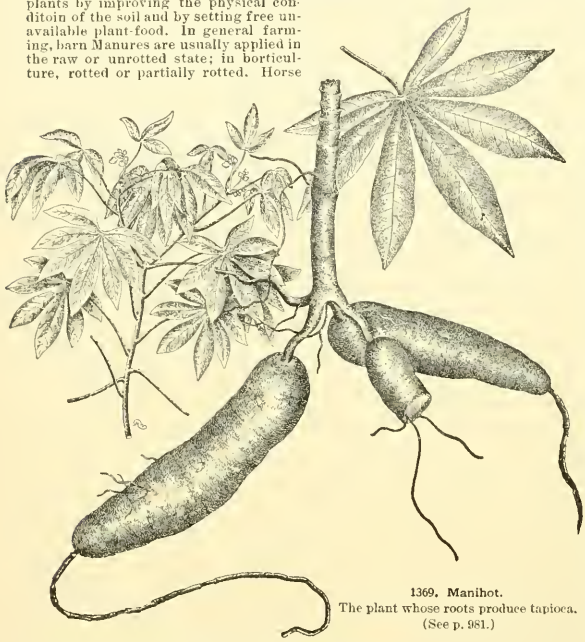
of collecting and proving varieties of fruits. At the time of his death this garden contained more varieties of fruits than had ever been collected in America. Pears were his specialty, but he had all the fruits which would thrive in his climate. These fruits numbered nearly 2,000 varieties, of which about one-half were pears. These varieties were gathered from all parts of this country, and also from Europe. The new pears of Van Mons, the Flemish scientist and propounder of a theory of plant variation (see "Survival of the Unlike," Essay V), were introduced largely by him. He also received valuable acquisitions from Robert Thompson, of the fruit department of the London Horticultural Society. In 1838, Manning published at Salem his "Book of Fruits, being a descriptive catalogue of the most valuable varieties of the pear, apple, peach, plum and cherry for New-England culture." It also contained bush-fruits, grape and hardy trees and shrubs. It was published as "First Series for 1838," which indicates that its author intended to issue other parts. All the descriptions were drawn from the fruits themselves. The book was well illustrated. In this work he was assisted by John M. Ives: and Ives made a second edition of the work in 1844 under the title "Book of Fruits," and a third in 1847 as "New-England Book of Fruits." At this day it is difficult to appreciate the work of a man like Manning. In those days, varieties were all-important. The scientific management of orchards had not yet arisen. Varieties were confused. Manning and his compeers opened the way for correct nomenclature and systematic pomology, and established the idea of testing varieties. His decisions on nomenclature were accepted as final. He was one of the founders of the Massachusetts Horticultural Society. For a reference to the position of Manning's work in our history, see the article *Horticulture;* also Tilton's Journ. Hort. 7, pp. 157–8. His son, of the same name, is secretary of the Massachusetts Horticultural Society.

L. H. B.

MAN-OF-THE-EARTH. *Ipomœa pandurata.*

MANURE (from old French *manuvrer,* to cultivate by hand; Latin *manus,* hand, and *opera,* works). In the broadest sense, Manure is any substance applied to the soil for the purpose of increasing productivity. The excrements of animals, mixed or unmixed with straw or

other absorbents, are usually spoken of as barn Manures. Commercial Manures or "fertilizers" are usually concentrated forms of nitrogen, potash and phosphoric acid, mixed or unmixed (see *Fertilizers*); green Manures are living plants plowed under to furnish humus and increase productivity; amendments are substances, such as lime, which may increase the growth and healthfulness of plants by improving the physical conditoin of the soil and by setting free unavailable plant-food. In general farming, barn Manures are usually applied in the raw or unrotted state; in borticulture, rotted or partially rotted. Horse



1369. Manihot.
The plant whose roots produce tapioca.
(See p. 981.)

Manure is used for hotbeds, while cow Manure, mixed with soil, is best for forming a moist, rich, potting earth. Dung, the solid voidings of animals, after weathering for a time, is also a valuable addition to potting earth. Florists often keep a number of dairy cattle that an abundant supply of bovine Manure, which is so valuable in floriculture, may be at hand. Commercial Manures are used in small quantities, either direct or in solution. Nitrogen stimulates the vegetative system and tends to produce rapid growth and dark foliage. Phosphoric acid, among other effects, has that of producing well-developed plump seeds and fruits; potash may augment these effects, as well as increase and intensify the color of the bloom.

Barn Manures are more highly prized than formerly. Waste of their valuable constituents is now largely avoided either by applying them to the land day by day, as they are produced, or by more rational methods of caring for them until they are partly rotted or opportunity is afforded for most suitable application to the land. Covered yards or pits are now sometimes used for temporarily storing Manures, where they can have water added if too dry and if likely to "firefang;" or absorbents, such as straw, dry muck, gypsum and the like, may be used if they are too watery. When bedding is abundant, the animals may take their exercise in the covered yard, as they will solidify the Manure by tramping it, thereby diminishing loss by too rapid fermentation. Salt and gypsum both conserve plant-food in manures when spread over the mass from time to time in small quantities. The quantity and value of Manure made by domestic animals is not realized by those who allow it to be scattered over large, open barnyards or allow it to remain for considerable periods under the eaves of the barn. Extended experiments at the Cornell Experiment Station showed that the following amounts of excrements were produced daily for each 1,000 pounds of live weight of animal:

Sheep	34.1 lbs.
Calves	67.8 lbs.
Pigs	83.6 lbs.
Cows	74.1 lbs.
Horses	48.8 lbs.
Fowls	39.8 lbs.

Animals fed on a highly nitrogenous or narrow ration (as 1:4), as were the pigs in the above investigations, consume large quantities of water and produce a large amount of Manure, the weight of which often exceeds the amount of food consumed; while those fed on a carbonaceous or wide ration (as 1:9) consume comparatively little water and produce less weight of manure.

Some conditions affecting the production of Manure and its value may be stated as follows: If the plant-food value of Manure is computed at the price that is paid for the same constituents in fertilizers, it is found that the value of Manure produced by animals is equal to 30 to 50 per cent of the cost of their food. Young animals produce poorer Manure than mature ones. The excrements of animals which give a product, as milk or young, are poorer than those from non-productive animals. The more abundant the ration the less complete the digestion and the greater the value of the Manure produced. Concentrated and nitrogenous foods result in richer and more valuable excrements than unconcentrated or carbonaceous foods. Liberal salting and excessively succulent foods diminish the value of Manures. The amount and kind of bedding affect not only the quantity but the value per ton. Animals kept in cold quarters drink little water, digest their food closely and produce a Manure relatively small in amount and poor in quality.

Rich Manures are relatively more valuable per unit of contained fertility than poor ones. Plants are most benefiteb when they receive extra nourishment in the early stages of their growth. Coarse, low-grade Manures should be weathered or rotted to improve their availability, even though some loss may occur. A unit of plant-food in high-grade fertilizers or well-preserved, rotted Manures is worth more than in low grades. The valuable constituents in farm Manures are not so quickly available as they are in high-grade fertilizers, but they have an additional value, since they furnish humus, lighten the soil and increase its power to hold moisture, while assisting in liberating the mineral constituents of the soil. The value of Manure as set down below is determined by investigations during the winter months, and the nitrogen, phosphoric acid and potash are computed at 15, 6 and 4½ cents per pound, respectively. The indirect beneficial effects of Manure are considered an equal offset for the slightly less availability of their plant food constituents as compared with fertilizers:

Kind of Manure.	*Value per ton.*
Sheep	$3 30
Calves	2 17
Pigs	3 29
Cows	2 02
Horses	2 21

Limited amounts of bedding were used in the tests from which the foregoing figures were made.

Kind of animal.	*Value per year.*
Fowls (1,000 lbs. of)	$51 10
Sheep " "	26 09
Calves " "	24 45
Pigs " "	60 88
Cows " "	29 27
Horses " "	27 74

Usually these animals are kept in the stables but half of the year, and inevitably some loss will occur, therefore it will be safe to estimate the recovered value per year at one-third to one-fourth of the above.

Heretofore the waste of the valuable constituents of Manures in the United States has been very great. Until recently, large, open barnyards have been the rule. In the northern and central parts of the United States the rainfall exceeds 30 inches per annum. Many barnyards contain from a quarter to half an acre. One inch of rainfall equals 113 tons of water per acre. If this be multiplied by thirty, a fairly accurate estimate is secured of the water which largely passes through or over the Manure and carries off its most soluble and hence most valuable constituents. The loss of value in Manures exposed at Ithaca, in loose heaps of from two to ten tons, during six months, was as follows:

1889. Horse manure	42%
1890. Horse manure	62%
1890. Cow manure	30%
1889. Mixed, compacted	9%

Even in horticulture, where a more liberal use of Manure than in general farming is admissable, too much reliance is often placed on Manures and too little on tillage. Manures may furnish plant-food, improve the physical condition of the soil, conserve and increase heat and moisture. Ten to twenty times as much food as the plants can utilize is sometimes applied. Growth and development are more largely determined by the amount of moisture than by the amount of plant-food. Five tons of preserved barn Manure contain of nitrogen, phosphoric acid and potash, 60, 30 and 45 pounds, respectively. Twenty-five bushels of wheat, with straw, contain 45 lbs. of nitrogen, 18 lbs. of phosphoric acid, and 27 lbs. of potash. Most soils contain large amounts of unavailable or difficultly available plant-food. Manures should be used largely to feed plants between the time the nutrients in the seed have been exhausted and that when the plants have secured a firm hold on the soil by manifold rootlets. Except where otherwise most suitable and convenient, barn Manures should be spread thinly in the autumn or early winter on the surface where plants are growing, thus imitating nature's methods of maintaining and increasing productivity. I. P. ROBERTS.

MAPÀNIA (aboriginal name). *Cyperàceæ*. Perhaps 6 or 8 described species in tropical countries, comprising strong perennial herbs, with broad and strong lvs. arising from the crown, and large fl.-clusters on mostly leafless scapes: the small, perfect fls. contain usually 6 hypogynous scales, usually 3 stamens, and 3 filiform stigmas: nutlet sessile, 3-angled. The only species in the Amer. trade is **M. pandanæfòlia**, Sander. Its nativity is not given, and it is possible that it does not belong to this genus (see Gt. 46, p. 522). The plant is represented as pandanus-like, 3–4 ft. high, with long, narrow, graceful, stiffish lvs. G.C. III. 21:349. Gt. 46, p. 523. In European garden literature, **M. lùcida**, N. E. Brown, and **M. hùmilis**, Vill. (from Malaya), are also described. Index Kewensis regards these species as one, *M. humilis* being the older name. It is an erect-growing plant with oblong strong-ribbed lvs., which are produced into long petioles and taper into long tail-like points. I.H. 32:557. It is also known as *Pandanophyllum Wendlandi*, Hort.

L. H. B.

MAPLE. See *Acer*. **Flowering M.** = *Abutilon*.

MARÀNTA (B. Maranta, Venetian botanist, died 1754). *Scitaminàceæ*. About 10 or 12 tropical American herbs, very closely allied to Calathea, but distinguished amongst other things by having 2 of the 3 locules in the fruit empty. Most of the plants cultivated as Marantas are Calatheas; and the true Marantas are treated the same as those plants. These plants are often named before the flowers are known, and some of the following plants may belong to the genus Calathea.

A. *Leaves green, pubescent beneath.*

arundinàcea, Linn Figs. 1370–71. Branched, 2–5 ft. high, tuberous: lvs. ovate-oblong and pointed: fls. white in an open cluster, the upper lip roundish. Trop. Amer. B. M. 2307.—One of the sources of arrow-root (see *Arrow-root*), the plant being often called Bermuda Arrow-Root. The starch is obtained from the roots. It thrives along the Gulf coast, although little cultivated. There is a form with leaves variegated green and yellow.

AA. *Leaves green, marked with strong, parallel light-colored bars extending from midrib towards margin or with a whitish central stripe.*

splèndida, Lem. Glabrous: lvs. 2 ft. or less long, large, oblong-lanceolate, with base subcordate or somewhat cuneate, short-acuminate at apex, above shining dark green and marked with pale green transverse bars, beneath violet-red. Brazil. I.H. 13:467–8.—By some regarded as Calathea (*C. splendida*, Regel). Resembles *Calathea Veitchiana*, but more robust.

1370. Maranta arundinacea (× ⅓).

AAA. *Leaves blotched or banded with dark colors (sometimes contrasted with silvery colors).*

undulàta, Lind. & André (properly *Calathèa undulàta*, Regel). Six to 8 in. high, compact: lvs. ovate-oblong, the blade about 4 in. long, subcordate and unequal at

base, very short-pointed, the surface undulate, beneath purplish, above deep shining green, with a whitish feathery stripe through the center. Peru. I.H. 19:98.

leuconeùra, E. Morr. (*M. Kerchovèana*, E. Morr. *M. Kerchòvei*, Hort. *Calathèa Kerchoveàna*, Hort.). Dwarf, 6–8 in.: lvs. cordate-oblong, usually obtuse or very short-acuminate, grayish green with oblong purple spots on either side of the midrib. Brazil. I.H. 26:353.

13/1.
Maranta arundinacea.
(×½.)

Massangeàna, E. Morr. (*Calathèa Massangeàna*, Hort.). Larger in all its parts than the last: lvs. elliptic-ovate to obovate, rounded or truncate at base, the apex abruptly short-pointed, light purplish beneath, the upper part marked with three colors,—olive green towards the margin, broad central band of silvery gray, blotches of purple or maroon between the two. Brazil. F. S. 22:2364–5 (as *M. leuconeura*, var. *Massangeana*). J.H. III. 30: 499 (as var. *florentina*).

bicolor, Ker-Gawl. A foot high: lvs. roundish ovate, rounded or subcordate at the base, more or less wavy on the margin, abruptly short-pointed, light purple below, pale glaucous green above, with a relatively light-colored central band and very dark green or brown-green blotches midway between the rib and the margins. Brazil. B.R. 10:786. L.B.C. 10:921.

The following names are found in American trade-lists: *M. Baraquinii* = Calathea Baraquinii?—*M. Goveniàna*.—*M. iconifera*, Hort. (a form of Calathea Makoyana?), has lvs about 6 in. long, obliquely oval, yellowish green, with oblong, deep green spots or bars. Brazil.—*M. Lùbersi*. Foliage reticulated with yellow.—*M. musaica*, Hort. Lvs. 6–8 in. long, obliquely cordate, shining green, marked with many transverse veins. Brazil.—*M. Porteàna*. See Stromanthe.—*M. Sagoràna*, Hort. Dwarf: lvs. oblong, pale green, with oblong-oblique, deep green bars on each side of the midrib. S. America.—*M. sanguinea*. See Stromanthe.

See Calathea for the following names: *albo-lineata, argyrea, Bachemiana, Chimboracensis, eximia, fasciata, Fascinator, illustris, Lagerìana, Legrelliana, Lietzii, Lindeni, Makoyana, medio-picta, micans, nitens, ornata, princeps, pulchella, regalis, rosco-lineata, rosea-picta, smaragdina, tubispatha, Vandenheckei, Veitchiana, virginalis, Wagneri, Warscewiczii, Wioti, zebrina*. L. H. B.

MARÁTTIA (name from J. F. Maratti, an Italian botanist of the seventeenth century). *Maranthàceæ*. A genus of large, coarse-leaved fern-like plants with the sporangia borne in large, boat-shaped conceptacles on the under surface of the leaf. The species are strong-growing and ornamental, some of them reaching considerable size.

fraxinea, Smith (*M. élegans*, Endl.). Lvs. bipinnate, 6–15 ft. long, on stalks often 1 in. or more thick; pinnules 4–6 in. long, ½–1½ in. wide, of a leathery texture and naked surfaces: receptacles submarginal. West Africa to Malaysia and New Zealand. L. M. Underwood.

MARCGRÀVIA is a genus of Ternströmiaceæ, but *M. paradoxa* = *Monstera acuminata*.

MARCHÁNTIA (Nicholas Marchant, French botanist). *Marchantiàceæ*. A common liverwort, spreading its leaf-like forking thallus on moist earth. **M. polymórpha**, Linn., has been offered by dealers in native plants, the sods of it being sold for colonizing in rock gardens. It often grows on damp sills and walls in greenhouses. The flat thallus is often 4–5 in. long and 1 in. or more wide, from which rise peduncles 1 in. high, bearing the antheridial disk or shield and the star-like carpocephalum on similar stalks 1–3 in. high.

MARGUERITE or PARIS DAISY is *Chrysanthemum frutescens*. **Blue Marguerite** is *Felicia amelloides*. **Reine M.**, of the French, is *China Aster*.

MARGYRICÁRPUS (Greek, *pearly fruit;* referring to the white berries). *Rosàceæ*. Five species of South American subshrubs, of which *M. setosus* is a heath-like plant cult. in rockeries for its numerous small white berries, which are seen to best advantage against dark background. The nearest genus of garden value is Acæna, which has fls. in heads, while those of Margyricarpus are solitary and axillary. Branching shrubs with inconspicuous fls. which are sessile and have no petals. Lvs. alternate, crowded, overlapping: calyx tube persistent; lobes 4–5: ovules solitary, hanging from the top of the cell.

setòsus, Ruiz & Pav. Low-growing. Peru, Chile.—Int. by Franceschi. Hardy in England. Sometimes called Pearl Fruit.

MARÌCA (meaning doubtful; the author of the genus did not explain). *Iridàceæ*. Eleven species of tropical American plants allied to Iris, but with shorter-lived flowers and convolute inner segments. Three species are procurable from Dutch dealers. The fls. are 2–4 in. across, the outer segments large, white or blue, the inner ones smaller, with complicated and beautiful coloring. They are planted in the fall, and are hardy with winter covering. The genus is nearest to Cypella, but the style crests are petal-like, while in Cypella they are spur-like or flattened. Rootstock a short rhizome: lvs. sword-shaped, 2-ranked: fls. blue, yellow or white. Baker, Irideæ, 1892.

A. *Outer segments pure white.*

grácilis, Herb. Lvs. 1–1½ ft. long, ¼–1 in. broad: fls. 2 in. across. B.M. 3713.

AA. *Outer segments white, marked at the base with brown and yellow.*

Northiàna, Ker. Lvs. 1½–2 in. broad: fls. 3–4 in. across. B.M. 654. I.H. 42:40 (var. *splendens*).

AAA. *Outer segments blue.*

cærùlea, Ker. Lvs. 1–1½ in. broad: fls. 3–4 in. across. B.M. 5612 (as *Cypella cærulea*). B.R. 9:713. Gn. 25, p. 313. K.W. 1:40.

M. Califórnica. See Sisyrinchium.

MARIGOLD. The oldest kind is the Pot Marigold, the dried fls. of which are used to season soups. It is also cult. for ornament. See *Calandula officinalis*. The **French Marigold** is *Tagetes patula;* the **African**, *T. erecta*. The African Marigolds are mostly pure lemon- or orange-colored; the French ones have these colors and brown also, and are often striped. For **Cape Marigold**, see *Dimorphotheca*. For **Fig Marigold**, see *Mesembryanthemum*. **Marsh Marigold** is *Caltha palustris*.

MARINE IVY. *Cissus incisa*.

MARIPOSA LILY. See *Calochortus*.

MARIPOSA TULIP. *Calochortus*.

MARJORAM, SWEET. *Origanum*.

MARKERY, MERCURY. See *Chenopodium*.

MARROW, VEGETABLE. See *Squash*.

MARRÙBIUM (old Latin name of obscure meaning). *Labiàtæ*. A genus of about 40 Old World species, including the common Horehound, a hardy, perennial, bitter-aromatic herb, growing 1–3 ft. high, with whitish, hairy, crenate lvs., and axillary whorls of small whitish fls. It is a native of Europe, Asia and northern Africa, now found as an escape from gardens in waste places of nearly every country of the world. Horehound is

used in large quantities for confections and medicines for coughs and colds.

Marrubium comprises similar perennials branched from the base, with wrinkled and crenate or cut lvs., and many-fld. axillary whorls of small white or purplish fls.: calyx tubular, 5–10-nerved and with 5 or 10 awl-shaped teeth.

vulgàre, Linn. Common Horehound. Height 1–3 ft.: stems ascending: lvs. ovate, stalked: calyx with 10 recurved teeth, the alternate ones shorter: fls. white. Summer. B.B. 3:84.

Horehound (or Hoarhound) in America has become a common weed in New England, Indiana and upon the Pacific coast, especially south of San Francisco. From the last region is obtained Horehound honey, a product considered useful in the treatment of coughs and colds. The leaves and tops have a bitter, penetrating taste and a strong, not unpleasant odor, which is somewhat dissipated by drying. In addition to its well-known uses in pulmonary troubles, it is credited with tonic, laxative and, in domestic medicine, deobstruent properties. The plant prefers a dry, warm, ratherrich, light soil. It may be readily propagated by division of the clumps or by seed sown in the spring where the plants are to remain. The drills should be 2 feet apart and the plants 1 foot asunder. With clean cultivation and moderate annual manuring two abundant cuttings should be obtained each year. Since the market is fully supplied by the wild plants and since, when once established, it will grow almost spontaneously, the cultivation of Horehound is not recommended except to supply private needs. M. G. Kains and M. B. Coulston.

MARSDÈNIA (William Marsden, 1754–1836, wrote a history of Sumatra). *Asclepiadàceæ.* About 50 species of tropical and subtropical shrubs, mostly twiners, of which about half a dozen species are cult. in Europe under glass. *M. Roylei,* a fiber and dye plant from the East Indies, was introduced by Reasoner in 1889, but is now lost. The genus is allied to Stephanotis, which has large white fls., while those of Marsdenia are usually purplish, lurid, greenish or pallid. Lvs. opposite: cymes umbel-shaped, simple or branched, terminal or axillary: calyx 5-parted: corolla bell-, urn- or salver-shaped; lobes narrow or broad, overlapping to the right: crown of 5 scales: seeds comose.

Róylei, Wight. Lvs. 3–6 in. long, 2–4 in. wide, ovate cordate, acuminate, pubescent or tomentose beneath; petioles 1½–2 in. long: cymes 1–1½ in. across: fls. 3–4 lines in diam.: corolla somewhat bell-shaped; lobes large, fleshy; stigma not extended beyond the anthers: seeds ½ in. long. L. H. B.

MARSHÁLLIA (Humphrey Marshall, wrote Arbustum Americanum, 1785, the first American work on our trees and shrubs; also founded one of the first American botanic gardens). *Compósitæ.* About 9 species of perennial North American herbs, of which only one species, *M. cæspitosa,* seems to have been offered. Marshallias are tufted plants, growing about a foot high, with entire lvs. and scapes bearing solitary rayless heads about 1½ in. across. Somewhat like the common Scabious. These are rose-purple or white, with blue anthers, and appear in spring or summer. For fuller description, see our manuals.

cæspitòsa, Nutt. Tufted, glabrous: lvs. spatulate-linear; upper ones linear: bracts of the involucre linear: disk-fls. pale rose or white: seeds inversely pyramidal, villous on the angles. Limestone soil, Ark. to Tex. B.M. 3704. B.B. 3:443.

MARSH MALLOW. *Althæa officinalis.*

MARSÍLEA (Giovanni Marsigli, Italian botanist of last part of the eighteenth century, or Aloys Ferd., Graf von Marsigli, 1658–1730). *Marsileàceæ.* Aquatic flowerless plants (about 10 species), with lvs. like 4-leaved clover or oxalis, one species of which, *M. quadrifolia,* Linn., is sold and is also run wild in the eastern states. It is a creeping plant, rooting in the mud on the margins of ponds and making an attractive cover. The petioles grow 3–5 in. tall, or taller in the water, and bear at the apex 4 bright green obcuneate or triangular leaflets. The sporocarps or fruits are nearly sessile at the base of the petioles. Prop. easily by pieces of the runners, and is likely to become a weed. The young leaflets close at night. Europe and Asia. Mn. 6, p. 107.

MARTINÈZIA (Rev. Dr. Baltasar Jacobo Martinez Companon, archbishop of Santa Fé, who sent many early collections of plants from Peru). *Palmàceæ.* Ornamental palms, with spiny ringed trunks: lvs. pinnate, the segments broad, wedge-shaped, alternate or grouped, the apex truncate and ragged: petioles and rachis spiny, as are also the spadices and spathes of the inflorescence: fls. rather small: fr. globose, 1-celled, orange, scarlet or rose-pink. Species 7. Trop. Amer.

Jared G. Smith.

Martinezias are beautiful palms, and make fairly good house plants. They must have a stove temperature. They do not require a great amount of soil. Light sandy loam, with plenty of sharp sand, is best. They need abundant moisture. They sometimes flower in cultivation, but the 4 kinds given below are distinct by their foliage and spines. Like all armed palms, they are slow to germinate, but after the first or second year they grow fairly fast. The commonest and best kind is *M. caryotæfolia,* which has fewer spines than the other species and, unlike many other palms, shows its true lvs. at a very early stage. It resembles the fish-tail palms (Caryota), but the lvs. are a lighter green and generally larger. *M. erosa* makes a better specimen at 5–6 ft. than when small. It is much more jagged at the tips of the lvs. Being very spiny all over, it is less desirable. *M. Lindeniana* is more like the first. The spines are longer but not very numerous. *M. Granatensis* is of coarser habit and slower growth, and desirable only for large collections. H. A. Siebrecht.

A. *Lvs. divided into segments.*

B. *Segments in groups.*

C. *Apex of segments 3-lobed.*

caryotæfòlia, HBK. Stems at length 30 to 50 ft. high: lvs. few, 3–6 ft. long, light green; lfts. in groups, 6–12 in. long, 4–6 in. wide at the apex: stem, petioles, rachis and nerves below, densely clothed with long black spines. Colombia. G.C. 1872:181. B.M. 6854. F.R. 2:49.

CC. *Apex of segments with a point projecting from the upper margin.*

Lindeniàna, H. Wendl. Stems 9–15 ft. high: pinnæ in opposite groups of 4 to 6, the groups widely separated, long-wedge-shaped, 10–14 in. long, 8–10 times as long as broad, with a short, projecting point at the upper margin, the nerves ciliate-spiny toward the end: petiole densely covered with grayish brown hairs, with many rather large black spines 1–2½ in. long: rachis is also spiny above and below: midnerve of each segment a trifle shorter than the lower margin and spiny beneath, like the rachis and lateral nerves: lvs. dark green above, lighter beneath; terminal segment broadest: fr. rose-red. Mountains of Colombia, at an altitude of 6,000 ft.

BB. *Segments in 2–4 pairs.*

erósa, Linden. Lvs. with 2–3 pairs of narrow lfts. at base and a pair of broader ones at the apex, all oblique at the apex, bearing long, brown, needle-shaped spines on the veins and midrib: rachis cylindrical or obtusely angled, mealy, clothed with spines like those on the lvs. West Indies. G.C. 1872:1297.

AA. *Lvs. bifid at the apex.*

Granaténsis, Hort. (*M. Granadénsis,* Hort.). Lvs. roundish oblong or roundish ovate, entire at the base, bifid at the apex, evenly toothed along the edges: petioles and rachis with dark brown, needle-shaped, spreading or reflexed spines, ½–1 in. long. Colombia.

Jared G. Smith.

MARTÝNIA (John Martyn, 1699–1768, professor of botany at Cambridge, botanical author and editor of the largest edition of Miller's "Gardeners' Dictionary"). *Pedaliàceæ* About 10 species of coarse annuals from the warmer parts of America, a few of which are cult. for pickles or for ornament. They have large showy fls. much like those of Catalpa in form, the 2

upper lobes being smaller than the 3 lower. The fls. are 2 in. or more across, chiefly lilac, purple or yellow but spotted and marked about the throat with other colors. They are heavily scented and interesting, but, like all other parts of the plant, they are clammy. The plants grow 1½ ft. or more high, and should be started in a hotbed in early spring in the North and transplanted to the open. In the middle and southern states seed may be sown in the open 3 ft. apart each way where the plants are to remain. The capsules are taken when small and tender and pickled like cucumbers. They have a very distinct appearance by reason of the long-curved horn which splits from the top as the capsule hardens.

The small family to which Martynia belongs is allied to the Bignonia family, and the fls. are much alike, but the habit and fruit are different. Martynias are either annuals or perennials, with large tuber-shaped roots, prostrate or suberect and clammy: lvs. opposite or alternate, long-stalked, cordate, coarsely wavy-margined or toothed, or palmately lobed: fls. 5–8 in a short, terminal raceme: capsules with 2 short or long horns.

The first three species described below belong to the subgenus Proboscidea, which has 4 perfect stamens and long-horned capsules. They vary considerably in the foliage, roundish or wider than long, 3-lobed, sharply 3-cnt or entire except the notch, which is always found at the base, margin toothed, angled or wavy.

1372. Martynia proboscidea (× ⅛).

A. *Fls. lilac or dull white.*

proboscidea, Glox. (*M. Louisiàna,* Mill.). Unicorn Plant. Proboscis Flower. Fig. 1372. Lvs. roundish, often oblique, entirely obscurely wavy-lobed, 4–12 in. wide: fls. also vary to light yellow. Banks of Mississippi; nat. near old gardens. B.M. 1056. V. 3:151.—The picture (Fig. 1372) shows fruits one-third the size at full maturity. The right-hand specimen shows the woody part, after all the soft parts have been macerated.

AA. *Fls. purple.*

frágrans, Lindl. (*M. formòsa,* Vilm.). Less stout than *M. proboscidea:* lvs. roundish to oblong-cordate, somewhat lobed and wavy-toothed, 3–5 in. broad. Mex. B.M. 4292. B.R. 27:6. R.H. 1843:248.

AAA. *Fls. yellow.*

lùtea, Lindl. Lvs. cordate-orbiculate, subdentate, glandular-pubescent. Brazil. B.R. 11:934.

AAAA. *Fls. white.*

Craniolària, Glox. Properly *Craniolària ánnua,* Linn., a genus distinguished by having a very long and slender corolla tube, while in Martynia the corolla tube is swelled out at a very short distance from the base. Lvs. palmately lobed; margins dentate: corolla tube about 6 in. long. Colombia.—Some of the plants sold under this name are *M. proboscidea;* others are *M. fragrans.*

W. M.

MARVEL OF PERU. *Mirabilis Jalapa.*

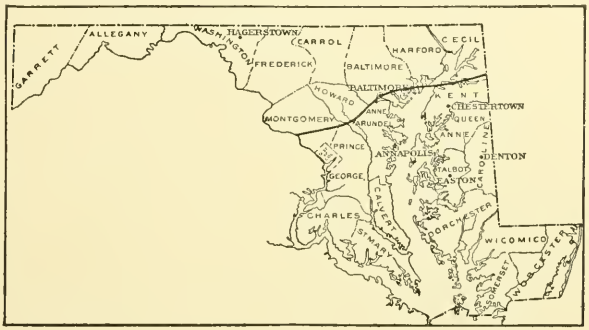
MARY, BLUE-EYED. *Tradescantia Virginica.*

MARYLAND, HORTICULTURE IN. Fig. 1373. All of this state lying south of Baltimore possesses notable horticultural possibilities. The lands are quite variable in composition, and are very sensitive and responsive to judicious and rational treatment. In the production of early fruits and vegetables, the natural adaptability of soil, the mild and equable temperature resulting from the influence of the expansive waters of the Chesapeake bay, which cuts the state in two, as well as from geographical location and convenient access to all the principal eastern city markets, are the conditions which combine in a presentation of rare inducements that are not fully appreciated by the rural citizenship of the locality. Fully three-fifths of the farms in Maryland, by circumstances as above briefly indicated, are specially adapted to horticultural pursuits. The eight counties forming a tier, extending from east to west along the northern boundary of the state, do not enjoy so wide a range in horticultural favor as the central and southern counties. The wonderful development of the fruit and vegetable packing or canning industry in the state is to a very noticeable degree encouraging, and accomplishing a diversification for the promotion and betterment of horticulture. In the city of Baltimore the "packing" business has assumed huge proportions, but independent of this, the business has in the aggregate, throughout the several counties, reached a large volume, which is annually increasing. Caroline county, centrally located on the Eastern Shore, annually operates more than a score of such houses. Strawberries, blackberries, peaches, pears, peas, tomatoes and sweet corn constitute the principal articles canned. No fancy prices for either fruits or vegetables are obtained in the local markets thus created, but a great good to horticulture growing out of these operations is that they are inducing many hard-worked and poorly paid tillers of the soil to climb out of the old ruts, giving them a practical education or training that enables them to grow and prepare products for the city markets in keeping with modern demands. Thousands of acres in this state are now devoted to peas, tomatoes and sweet corn for the packing houses. Summarized, this means more manure—better methods—better land.

For many years the peach maintained undisputed supremacy in the fruit interests of Maryland. Enthusiasm extended the acreage beyond the capacity for proper care and culture, thus inviting the encroachment of disease and insect enemies to an extent that has served to circumscribe the misdirected ambition for large orchards, and has robbed peach-growing of much of its fascination. In the aggregate, the orchard acreage is still immense; but old orchards are going out to a much greater extent than new ones are being planted. In the northern tier of counties, interest in apple-growing is increasing. Cherries, too, in many locations in this part of the state are successfully grown. Pears are more generally grown and satisfactory throughout the state than cherries. Kent and Queen Anne counties, of the Eastern Shore, excel in the production of pears, both in quantity and quality. Plums of the native and Japanese species receive considerable attention, and in many instances prove more remunerative than other fruits. Small fruits of all kinds are grown in great abundance. The large fruit interests of the state create and maintain a large local demand for nursery stock, which is shared by the forty nurseries in various parts of the commonwealth. Several of these establishments make the propagation of peach trees a specialty, growing them by the hundreds of thousands, and disposing of them in a wholesale way to their fellow-nurserymen in localities less favored for propagating these trees. In a few of the Western Shore counties tobacco still figures to some extent in soil products; on the Eastern Shore tobacco has been superseded largely by sweet potatoes, to the decided benefit of both land and landlord.

The division of the state by the Chesapeake bay keeps the Eastern Shore out of touch in more ways than one with the rest of the state. The experiment station is located on the Western Shore, where the horticultural

interests are on lines more or less distinct from those on the Eastern Shore. Greater harmony obtains between the conditions of the Eastern Shore and of Delaware; hence it naturally follows that horticultural relations between the Eastern Shore of Maryland and the state of Delaware are closer and more intimate in many respects than those between the two "shores" of Maryland, and doubtless will remain so unless counteracted by the establishment of an active and well-equipped sub-station on the Eastern Shore. The entire peninsula, comprising Delaware's three, Maryland's nine and Virginia's two counties, should properly constitute one state, as nature seems to have intended. If these fourteen peninsula counties were banded together by the ties of statehood, and thus governed solely by their own citizens, it could not do otherwise than promote and accelerate the progress in horticultural advancement, and make it by concentrated art and practice what it is by nature, America's Eden. It is capable of supporting a population ten times as large as at present inhabits it, with an overflow sufficient to feed five times as many more in the large near-by cities with choice fruits and vegetables, easily grown in endless variety.



1373. **Maryland.** The strong line sets off the horticultural regions to the south.

Maryland's metropolis, with its rapidly improving facilities for distributing to other cities and towns, affords much encouragement and gives impetus to all horticultural operations. Baltimore market is the main dependence of the Western Shore and western Maryland fruit-growers and truckers; while a large share of the horticultural products of the Eastern Shore, owing to convenient accessibility, are consigned to New York, Philadelphia and Wilmington. The General Assembly or Legislature of Maryland has never, until quite recently, done anything to promote or protect, by appropriation or otherwise, the great horticultural interests of the state, while it has expended hundreds of thousands of dollars to exploit and protect the oyster and fish industries. The value of the small-fruit crop reaches into millions of dollars annually. Add to this the peaches, pears, apples, plums, cherries, etc.—then couple to all the vast volume of vegetable production throughout the state—grasp all this, and crowd it into the two words—*horticultural interests*, and here are the data in the form of unmanufactured material, and the nearest approach to synthetical statistics that is available. That horticulture takes rank with the greatest industries of the state is obvious to any unclouded comprehension. The soil of fifteen of the twenty-three counties comprising the commonwealth, reveals unmistakable evidence that nature, in loving pride, planned a brilliant horticultural destiny for them, holding out conspicuously, among numerous other incentives, a climate promotive of health, pleasure and prosperity. Violent extremes of heat and cold, so troublesome, annoying, and even disastrous in many other sections, are rarely if ever experienced here. Industrial evolution is steadily giving trend toward higher development of horticulture in the state.

J. W. Kerr.

MASDEVÁLLIA (Joseph Masdevall, a Spanish physician and botanist). *Orchidàceæ*, tribe *Epidéndreæ*. Masdevallias are inhabitants of the American tropics. There are more than 150 species, and various hybrids and garden forms. They are not showy orchids, but are odd and often grotesque. The petals are small and usually hidden in the calyx-tube, but the 3 calyx lobes are greatly developed and give character to the flower. Often these lobes end in slender tails several inches long. Lip of the corolla short, articulate with the base of the winged or wingless column, in some species sensitive. Pollinia 2, without caudicles. The Masdevallias have no pseudobulbs; the leaves are variable in size, oblong to linear, thick, sheathing at the base; the peduncles bear from 1–5 or more flowers. The species of the *M. coccinea* group are relatively simple in form, but are usually prized for their brilliant coloring. Those of the *M. Chimæra* group are remarkable for their fantastic shapes. Of late years many new kinds have been introduced, and the genus is somewhat confused as to the specific limits of the various forms. Masdevallias are polymorphous, and herbarium specimens do not show specific characters well. See "The Genus Masdevallia," by Florence H. Woolward (1896).

L. H. B.

Masdevallias are found growing at high elevations, ranging from 6,000 to 12,000 feet above sea level, in northwestern South America and Central America, with a few sparingly distributed elsewhere over tropical America. These regions are generally subjected to two rainy seasons annually, often with very short intermissions. The atmosphere, though somewhat rarified, is very humid, the temperature in the shade seldom rising above 65° F., and often dropping to 40° in some districts. Heavy fogs are frequent, especially in the forepart of the day, and during the greater portion of the year the under-vegetation is in a saturated condition; the high winds prevalent in these districts, however, counteract to a great extent any evil influence which might otherwise arise from it.

The heat of our summer makes it quite impossible to imitate wholly the above conditions, but with a proper house, such as is afforded Odontoglossums of the cristpum section, very satisfactory results may be obtained and the many species will be found of comparatively easy culture. A low, well-ventilated, half-span house of northern exposure, with an upright stone or brick wall on the south side, is best adapted to them. The house should be provided with canvas roll-shading, supported on a framework elevated 15 or 18 inches above the glass in order that the cool air may pass freely beneath it. This will help to guard against solar heat during summer. Houses built partly below ground are not to be recommended, as the atmosphere soon becomes stagnant and inactive, causing the leaves to fall prematurely. Where it is convenient, solid beds are preferable; benches, however, will answer the purpose very well, and when used should be covered about 2 inches deep with sifted ashes, sand or gravel; the benches and floors should be hosed down once or twice daily to afford all the cool moisture possible.

In winter the temperature should range between 50° and 55° F. at night and about 60° during the day or 5° more on mild days, with weak solar heat and ventilation. Artificial heat must be dispensed with as early in spring as possible, and during summer the temperature kept as low as the weather will permit, ventilating freely,

especially at night, when a light syringing overhead will also prove beneficial. Midday syringing in hot weather is often injurious and should be done with caution if at all. More benefit will result from hosing down the shelves and paths at intervals of three or four hours, as it will help to reduce the temperature.

Masdevallias need a great deal of water at the roots at all seasons, and the soil should never be allowed to dry out, as they have no fleshy pseudobulbs to protect them against extreme changes. Light syringing overhead during winter and spring in fine weather will assist in checking thrip and red spider, and a weak solution of tobacco may be added with good effect.

The best season for repotting and basketing the plants is during November and December, and the best general compost is a mixture of clean peat fiber and sphagnum moss chopped rather fine and well mixed, some sections requiring in addition a portion of chopped sod. About one-third of the space should be devoted to clean drainage consisting of either broken charcoal or potsherds.

M. coriacea, elephanticeps, Peristeria, Reichenbachiana, and kindred species, grow best in small pots, and should have one-third chopped sod added to their potting compost. *M. macrura, Schlimii, Tovarensis, amabilis, coccinea, Veitchiana, triangularis, polysticta, muscosa,* and the numerous other allied species, grow equally well in either pots or baskets, but should the latter be used it would be well to add a small portion of chopped sod to the compost to make it more firm and less porous; the sod has a cooling effect on the roots. *M. bella, Carderi, Chestertoni, Chimæra, Hauttcana* and their allies nearly all have pendulous flower-scapes, and should be suspended from the roof in baskets in a compost of equal parts chopped peat-fiber and live sphagnum, with a little leaf-mold added. The flower-scapes often penetrate through the compost; for this reason little or no drainage should be used, as it may retard their progress.

To increase the stock the plants must be divided during the early winter; this will give them a chance to reëstablish themselves before the following summer. They must not be broken up into too small pieces, as it has a tendency to weaken them. Cult. by R. M. Grey.

Review of the Sections.

Section I. Scape 1-fld.: calyx-tube rather narrow, tubular or somewhat funnel-shaped: labellum plane.....Species 1–7

Section II. Scape 1-fld.: calyx-tube broad, gibbous or basin-like: labellum plane.....Species 8–24

Section III. Scape several-fld.: labellum plane and narrow .....Species 25–37

Section IV. Scape mostly 1-fld., pendent or suberect: labellum saccate, or at least much broadened: tails very long.....Species 38–44

Section V. Scapes 1-fld. This section differs from all the others by the subterete lvs., and in having the tails inserted below the apex of each lateral sepal .....Species 45

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SECTION I.

A. *Calyx-lobes glandular with minute papillæ* ..... 1. **Veitchiana**

AA. *Calyx-lobes not glandular.*

B. *Tail of the dorsal lobe hanging forward*..... 2. **militaris**
3. **rosea**

BB. *Tail of the dorsal lobe erect and straight*..... 4. **amabilis**
5. **Davisii**
6. **Barlæana**

BBB. *Tail of the dorsal lobe reflexed and flexuous*..... 7. **coccinea**

1. **Veitchiàna**, Reichb. f. Tufted: lvs. 4–6 in. long, narrow: peduncle erect and slender, 1 ft. or more, with 2 or more bracts (the upper one remote from the flower): calyx with bell-shaped tube, the expanding lobes 3 in. across, orange-red, with purple shades, glandular-hairy, abruptly contracted into short, narrow tails; petals white, hidden. Peru. B. M. 5739. — Var. **grandiflòra**, Hort., has a dense hairy covering on the dorsal lobe of calyx; and also on the outer part of the lateral lobes, the inner part orange-scarlet.

2. **militàris**, Reichb. f. & Warscz. (*M. ignea*, Reichb. f.). Much like the last, but differs in having elliptic or elliptic-obovate lvs., which are long-petioled, and in the lateral calyx lobes being only prominently pointed, not tailed, the dorsal lobe very narrow and hanging forward between the other two: color orange and scarlet; petals white, exceeding the column. Spring. Colombia. B. M. 5962. I. H. 26:333. — Var. **Massangeàna**, Hort. Lateral lobes longer: fls. larger. Var. **Bòddærti**, Hort. Calyx yellow; lower lobes shaded with red on the upper surface. I. H. 26:357. Var. **grandiflòra**, Hort. Fls. rounded; lateral sepals brilliant vermilion, bordered with crimson and suffused with purple. Var. **supérba**, Hort., is advertised.

3. **rósea**, Lindl. Lvs. oblong-spoon-shaped, keeled: peduncle drooping and slender, bearing a single fl.: calyx tube 1 in. long, red and violet; calyx-lobes rose-lilac, with red tails; petals yellow, the lip hairy at the apex. Ecuador. G. C. III. 16:657. July, Aug. — A pretty and free-flowering species.

4. **amábilis**, Reichb. f. & Warscz. Lvs. 4–5 in. long, oblong- or spatulate-lanceolate, about half the length of the erect, usually 1-fld. peduncles: fls. varying from purplish crimson to yellow; lobes ovate-triangular, the lateral ones with short tails and the dorsal ones with a long and ascending tail; petals narrow, yellowish, longer than the column. Peru. Sept.–Dec. — Var. **lineàta**, Linden & André (var. *striàta*, Hort.), has yellowish fls., tinged and striped with red. I. H. 22:196.

5. **Dàvisii**, Reichb. f. Densely cespitose: lvs. oblong-lanceolate, 6–8 in. long, petioled, blunt at the apex: peduncle erect, about 10 in. long: calyx large, brilliant yellow, obscurely veined with deeper yellow; dorsal lobe triangular-ovate, prolonged in a tail; lateral lobes oblong-ovate, larger, united to below the middle, terminating in short tails; petals longer than the column, nearly hidden in the calyx-tube, pale yellow, the labellum yellow, shaded and spotted with red, with 2 obscure keels. Peru. B. M. 6190.

6. **Barlæàna**, Reichb. f. Lvs. spatulate, acute: peduncle slender, nearly 1 ft. long: fls. scarlet; calyx-tube curved; dorsal sepals short-triangular, produced into a long tail; lateral sepals larger, semi-ovate; petals ligulate, white. Peru. — Reichb. states that the lateral sepals run internally one in another; they are connate in a straight line.

7. **coccínea**, Linden (*M. Lindeni*, André). Fig. 1374. Lvs. spatulate, obtuse or retuse, 6–10 in. long: peduncle 1 ft. or more long: calyx crimson-magenta; dorsal lobe with a small, triangular base, prolonged into a long tail; lateral lobes oblong-ovate, scarcely prolonged; petals white, longer than the column. May. Colombia. B. M. 5990. I. H. 17:42. F. M. 1872:28. — Var. **conchiflòra**, Veitch. Fls. large; lateral lobes of labellum rotund, concave. Var. **Harryàna**, (*M. Harryàna*, Reichb. f.). Lateral lobes of calyx oval, falcate, the tips usually crossing or turned toward each other. May. F. S.

21:2250. Var. **Armeniaca,** Hort. Fls. apricot-yellow, veined with red; throat of the tube yellow. Colombia. Var. **atrosanguinea,** Hort. Fls. large, with the lateral sepals crimson spotted with magenta, points falcate, turned toward each other. Colombia. Var. **cœruléscens,** Hort. Lateral sepals broadly semi-ovate, apiculate, crimson-magenta spotted with bluish purple. Colombia. Var. **Gràvesiæ,** Hort. Fls. white. Var. **grandiflòra.** Fls. large, rose-purple. Colombia. Var. **Dénisoni,** Hort. BULL'S BLOOD. Fls. crimson-purple.

SECTION II.

A. *Habit of scape drooping or deflexed.*
B. *Scape about as long as the lvs.* 8. **platyglossa**
BB. *Scape shorter than the lvs....* 9. **leontoglossa**
AA. *Habit of scapes erect or suberect.*
B. *Scape shorter than the lvs.*
C. *Lvs. linear to linear-oblong.* 10. **coriacea**
11. **civilis**
12. **Peristeria**
CC. *Lvs. oblong to lance-oblong..* 13. **corniculata**
14. **macrura**
15. **ionocharis**
16. **nidifica**
17. **calura**
BB. *Scape longer than the lvs.*
C. *Fls. rather small, with a broad, basin-like tube; plants dwarf .....* 18. **Shuttleworthii**
19. **Estradæ**
20. **xanthina**
21. **triangularis**
22. **hieroglyphica**
23. **Wageneriana**
CC. *Fls. larger, with a broad, deep, gibbous tube .....* 24. **elephanticeps**

8. **platyglóssa,** Reichb. f. Densely tufted: lvs. spatulate-lanceolate, narrowed into petioles, 3–4 in. long, as long as or longer than the drooping bracted 1–2-fld. peduncles: fl. small (1 in. long), pale yellow, nearly globular, the lobes pointed but not tailed, the dorsal one upcurved: ovary red; petals linear, as long as the column. Colombia (*?*) B.M. 7185.

9. **leontoglóssa,** Reichb. f. Tufted: lvs. oblanceolate, short-petioled, spotted beneath with red: peduncle deflexed, mostly shorter than the odd fls.: calyx narrow, the lobes gradually narrowed into fleshy tails or long points, semi-transparent, all of them greenish yellow outside and more or less hairy, crimson-spotted within, the dorsal lobe not greatly unlike the others but often somewhat ascending; petals white with crimson lines. Colombia. B.M. 7245.—The specific name ("lion-tongued") refers to the bearded lip.

10. **coriàcea,** Lindl. Lvs. linear-lanceolate, usually somewhat surpassing the erect, 1-fld., spotted peduncles, which are about 6 in. high: fls. fleshy, the calyx-lobes nearly equal and wide-spreading, triangular at base but gradually narrowed into long points or short tails; lobes greenish yellow and dotted crimson inside; petals white and crimson. Colombia. G.C. III. 21:95.—Lvs. 6–8 in. long, with purplish dotted petioles.

11. **civilis,** Reichb. f. (*M. rufo-lutea,* Lindl.). Lvs. fleshy, linear, keeled, 5–6 in. long: peduncle less than 2 in. long, erect or nearly so; fl. solitary, rather large for the size of the plant, the deep calyx-tube purple at the base and yellow at the top, the long-pointed, flattened lobes yellow: petals small, white, the labellum dotted purple. Peru. B.M. 5476.

12. **Peristèria,** Reichb. f. Tufted: lvs. oblanceolate, sometimes retuse at the apex, 4–6 in. long, twice longer than the rather stout, erect, 1-fld. peduncles: fls. with 3 long, wide-spreading tails, which span 4–5 in., the tube somewhat gibbous beneath; back of the fl. greenish yellow; tails honey-yellow; throat and base of lobes spotted with crimson; petals linear-oblong, white. Colombia. B.M. 6159. F.S. 22:2346.—Named from its resemblance to the dove orchid, Peristeria.

13. **corniculàta,** Reichb. f. Stems short and tufted: lvs. spatulate, very short-pointed, mostly exceeding the 1-fld. peduncles: fls. with yellow, inflated calyx-tube, which is spotted with brown and ribbed, bearing long, very slender brown tails; petals yellow. Colombia. Var. **inflàta,** Veitch. Paler in color, and with smaller spots; lobes broader and golden yellow. Colombia. B.M. 7476.

1374. Masdevallia coccinea (×¾).

14. **macrùra,** Reichb. f. Stems short and tufted, each bearing a solitary lf. and fl.: lvs. broadly spatulate or broad-oblanceolate, very obtuse or even retuse: peduncles 8–10 in. high, erect: fls. with 3 long tails, which span 8 in. from top to bottom; calyx-tube red-purple on the outside; lobes triangular-ovate in the basal portion, dull red and purple-spotted within, the cylindrical tails yellow, the lateral ones 7-ribbed; petals yellow, spotted brown. Colombia. B.M. 7164.

15. **ionócharis,** Reichb. f. Lvs. ovate-lanceolate, exceeding the erect peduncle: fl. whitish, purple-spotted at base, the lobes triangular-ovate, with yellow tails; petals cream-white. Peru.

16. **nidífica,** Reichb. f. Lvs. oval or oblong, about the length of or longer than the peduncle: fl. white, veined and dotted with crimson passing into yellow on the lobes, the lobes hairy and with long, slender tails, which are yellow in the lateral lobes and crimson in the dorsal lobe; petals white, with crimson lines. Ecuador.

17. **calùra,** Reichb. f. Lvs. mostly shorter than the peduncles, oblong-lanceolate: fl. glossy crimson, with slender, flat tails; dorsal lobe somewhat triangular at base, the lateral ones round-ovate; petals crimson, with white on tip and margins. Aug. Costa Rica.—A free-flowering species.

18. **Shúttleworthii,** Reichb. f. A small species, with lvs. only 2 in. long, on distinct petioles of equal length:

peduncles several, 1-fld., sometimes overtopping the lvs.: fls. large (1 in. across and the tails 2–3 times as long), mauve, dotted with crimson; tails all yellow in the upper half, very slender, the upper one sometimes bent or hooked at the top; petals white. Colombia. B.M. 6372. I.H. 28:435. Var. **xanthocòrys**, Reichb. f., has smaller fls. of pale yellow, dotted with brown or rose.

19. **Estrâdæ**, Reichb. f. Very densely tufted: lvs. and petioles 3 in. long, the blade broad, spoon-shaped, and often retuse at the apex: peduncle usually somewhat exceeding the lvs., erect, 1-fld.: flower of marked colors—the upper concave lobe yellow at base and violet-purple above, the lateral lobes violet-purple at base and white or straw-colored above; tails filiform, yellow; petals white, very small. Colombia. B.M. 6171.

20. **xanthina**, Reichb. f. Like the last, except that the flower is yellow, with a purplish spot on the lateral lobes. Var. **pállida**, Hort., has fls. almost white. Colombia.

21. **triangulâris**, Lindl. Lvs. oblanceolate: peduncle erect, about 4 in. tall: fls. yellow, marked or spotted with purple, the tails dark crimson: lobes similar, triangular-ovate; petals white, the lip spotted with pink or purple and hairy. Venezuela.

22. **hieroglýphica**, Reichb. f. Lvs. oval or oblong: peduncle short (about 3 in. long): flower with tube yellowish at bottom, becoming whitish, marked with crimson; lobes triangular-ovate, all with long tails, the tail of the dorsal lobe hanging forward and marked with purple at its base; petals yellow. June. Colombia.

23. **Wageneriàna**, Linden. Very small, neat and attractive, tufted, 2–3 in. high: lvs. spoon-shaped: peduncles equaling or exceeding the lvs., nearly erect: fls. yellow and crimson-dotted, with slender yellow tails, the upper one inclined backwards: lobes broad, cordate or ovate; petals yellow, odd in shape, the lip rhomboid and toothed. Venezuela. B.M. 4921.

24. **elephánticeps**, Reichb. f. An odd species: lvs. broad-spatulate, obtuse: peduncles 1 ft. long, erect: flower single, party-colored—the dorsal or upper lobe light yellow, the lateral ones ribbed and crimson; calyx-tube gibbous at the base below, all of them gradually produced into stout yellow tails (one of them often crimson), arranged so as to suggest the tusks and raised trunk of an elephant (whence the specific name). Colombia. F.S. 10:997. Var. **pachysépala**, Reichb. f. (*M. Moorediana*, Reichb. f.), has the dorsal lobe 3-nerved with crimson and the tube spotted.

SECTION III.

A. *Lvs. covered with round papillæ: scape hairy* .....25. **muscosa**

AA. *Lvs. smooth.*

B. *Fls. small, in many-fld. racemes, angles of the ovary crenulate or the petals toothed* .....26. **abbreviata**
27. **polysticta**
28. **melanopus**
29. **caloptera**
30. **pachyura**

BB. *Fls larger, often expanding in succession; raceme several-fld.; angles of the ovary and petals entire.*

C. *Color of fls. white* .....31. **Tovarensis**

CC. *Color of fls. yellow, dotted and shaded with brown or red.*

D. *Lateral sepals united, forming a boat-shaped cup* .....32. **Ephippium**

DD. *Lateral sepals nearly plane, at least not strongly cucullate.*

E. *Tails of the lateral sepals very short or none*.....33. **racemosa**

EE. *Tails of the lateral sepals long.*

F. *Lvs. broad, obovate-elliptic* ....34. **Schlimii**

FF. *Lvs. oblong-lanceolate or oblanceolate.*

G. *Calyx-tube funnel-shaped, narrowed at the base*.....35. **Reichenbachiana**

GG. *Calyx-tube broader or gibbous at the base*.....36. **maculata**
37. **infracta**

25. **muscòsa**, Reichb. f. Lvs. oval-oblong, papillose: peduncle hairy, 3 times exceeding the lvs., with 1 or more yellow fls.: lobes triangular, with reflexed tails; petals narrow and yellow with a brown line in the center, the lip bearing a raised yellow disk and moving upward with a jerk when this disk is touched. St. Domingo.—Fls. ½ in. across.

26. **abbreviàta**, Reichb. f. Lvs. oblong-lanceolate: peduncle many-fld., about 6 in. long: fl. white and freely dotted with red, the tails all deep yellow, the lobes serrate on the edges; petals white, longer than the column, serrate. Peru.

27. **polysticta**, Reichb. f. Densely tufted: lvs. narrow-spatulate, obtuse and often retuse: peduncle exceeding the lvs., about 8 or 9 in. tall and many-fld.: fls. pale lilac, spotted with purple, the margins of the sepals ciliate but not serrate, the tails very slender and spreading (fl. 2–2½ in. across) and yellowish; petals spatulate and serrate. Peru. B.M. 6368. I.H. 22:199. R.H. 1880:250.

28. **melanòpus**, Reichb. f. Much like *M. polysticta*: fls. smaller, white speckled with purple, the dorsal sepal keeled, the lobes not ciliate or serrate on the edges and very suddenly contracted into slender yellowish or dark-colored tails; petals linear-oblong, toothed below the apex. Peru. B.M. 6258 (as *M. polystícta*).

29. **calóptera**, Reichb. f. Lvs. oblong-ovate: peduncle short (5 or 6 in.), many-fld.: fl. white with crimson streaks, the tails all slender and orange; dorsal lobe keeled and somewhat hooded; the lateral ones ovate-oblong; petals white, crimson-keeled, serrate. Peru.

30. **pachyùra**, Reichb. f. Lvs. oval-oblong: peduncle erect, slender: calyx with triangular, short-tailed lobes, yellow, with transverse bars and spots of reddish crimson; dorsal sepal triangular, with a thick tail equaling the sepal in length; petals pale yellow. Ecuador. G.C. III. 22:255.

31. **Tovarénsis**, Reichb. f. Lvs. rather small, oblong-spatulate: peduncle 5 or 6 in. long, sometimes exceeding the lvs., 2-edged, several-fld.: fls. clear white and fragrant, the tails yellowish at the ends; dorsal lobe 1¼ in. long, very narrow and produced into a reflexed tail; lateral lobes oval, gradually produced into tails shorter than that of the dorsal lobe; petals white. Dec., Jan. Colombia. B.M. 5505. I.H. 26:363. Gn. 48:384. G.C. 1865:914; 1871:1421.—One of the best of the genus.

32. **Ephíppium**, Reichb. f. (*M. trochílus*, Linden & And.). Lvs. broad, oblong, 5–7 in. long: peduncle erect, about a foot long, sharply 3–4-angled, stout: calyx with the dorsal lobe cucullate, yellow, dotted with brown, ½ in. in diam.; lateral lobes united, forming a deep boat-shaped, chestnut-brown cup, with several ridges which are greenish outside; all the lobes pass into yellowish tails about 4 in. long; petals white. Colombia. B.M. 6208. I.H. 21:180.—According to Index Kewensis, *M. trochílus* and *M. Ephíppium* are distinct species. The former is described as having terete stems.

33. **racemòsa**, Lindl. (*M. Crôssii*, Hort.). Stems creeping: lvs. oblong-ovate, much shorter than the several-fld. racemose peduncles: fls. membranaceous, orange with red lines, erect, 1 in. across, tails very short or none; lateral lobes ovate, blunt-pointed, curving outward so as to form a 2-lobed limb, the dorsal lobe ½ in. long and pointed. Peru.—Not a popular species. Requires a coolhouse.

34. **Schlimii,** Linden. Tufted: lvs. elliptic-obovate, petioled, a ft. or less long, half shorter than the several-flowered peduncles: fls. dull yellow, mottled with bright brown, the tails yellow, about 1¼ in. across without the tails; tails 2–3 times longer than the body of the calyx-lobes, very slender; petals pale yellow, linear-oblong, equaling the column. Venezuela. B.M. 6740. G.C. II. 19:532.

35. **Reichenbachiàna,** Endres. Densely cespitose: lvs. oblanceolate, shorter than the several-fld. peduncles: flower dark red on the outside, yellowish, with red veins on the inside, all the lobes with turned-back tails, the lobes triangular. Costa Rica.

36. **maculàta,** Klotzsch & Karst. Lvs. narrow-oblanceolate, nearly or quite equaling the erect several-fld. peduncle (which is 8–10 in. tall): fls. yellow-tubed, suffused or dotted with red, all the lobes produced into orange-yellow or greenish tails 2 in. long; lateral lobes crimson, with yellow on the margin, the tails drooping; petals yellowish. Venezuela. F.S. 21:2150.

37. **infrácta,** Lindl. Cespitose: lvs. oblong-lanceolate to narrow-lanceolate: peduncle about 6 in. long, several-fld.: calyx pink-purple; dorsal sepals cucullate, lateral sepals entirely united, forming a wide, gaping tube, with cucullate sides and apex, passing into slender, yellowish tails; petals whitish, dotted with pink-purple. Brazil. F.S. 23:2389.

SECTION IV.

38. **Chimæra,** Reichb. f. Fig. 1375. Tufted: lvs. oblanceolate-obtuse, 1 ft. long and 1½ in. wide: peduncle wiry, erect, lateral or pendent, several-fld., mostly shorter than the lvs.: fls. opening in succession; calyx-lobes ovate, yellowish, much spotted with deep crimson-purple, tapering into slender tails from 3–11 in. long, purple-brown; petals white, marked with crimson; labellum saccate, white, yellow or pinkish, very variable. Colombia. R.H. 1881:130. G.C. II. 3:41.—One of the most fantastic of orchids, and the type of a most interesting group.

Var. **Rǽzlii,** Hort. (*M. Rǽzlii,* Reichb. f.). No long hairs on the calyx-lobes, the lobes very dark-colored, with short warts; labellum pink, not yellow. Color the darkest of the section. Often regarded as a good species. Sub-var. **rùbra.** Spots on calyx lobe brown-crimson.

Var. **Wállisii,** Hort. (*M. Wállisii,* Reichb. f.). Calyx-lobes with hispid pubescence, yellowish, spotted with brown-purple; labellum white, yellow within.

Var. **Winniàna,** Hort. (*M. Winniàna,* Reichb. f.). Calyx-lobes elongated, densely black-spotted. In part distinguished from var. *Rǽzlii* by its longer tails.

Var. **Backhousiàna,** Hort. (*M. Backhousiàna,* Reichb. f.). Lvs. narrower than in the type: fls. large; calyx-lobes more round, paler, not so thickly spotted; tails short; labellum nearly white. Perhaps a distinct species.

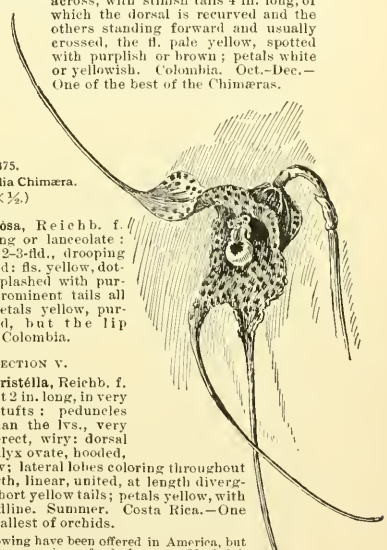
39. **Houtteàna,** Reichb. f. (*M. psittacìna,* Reichb. f.). Densely cespitose: lvs. linear to lance-linear, much exceeding the drooping or deflexed 1-fld. peduncles (which are 4–5 in. long): fls. creamy yellow, spotted with crimson, the long hanging tails brownish red; calyx-lobes semi-ovate to triangular, somewhat hairy (as are also the tips of the tails); petals white or pinkish. Colombia. F.S. 20:2106.

40. **Cárderi,** Reichb. f. Cespitose, with strong ascending foliage and hanging spotted 1-fld. peduncles: lvs. oblanceolate, 3–5 in. long: peduncles green-bracted, 3 in. long: fls. bell-shape, ¾ in. across exclusive of the tails, white, with purple and yellow bars at the base; tails very slender and spreading, 1 in. long, yellow; petals small, white, linear-oblong and obtuse. Colombia. B.M. 7125.—A graceful and pretty species.

41. **Chéstertoni,** Reichb. f. Tufted: lvs. oblong or oblong-spatulate, 5 in. long and nearly or quite 1 in. wide, somewhat longer than the pendent, much-bracted, 1-fld. peduncles: fl. 2½ in. across, greenish yellow, spotted and streaked with purple, and bearing 3 spreading, greenish, more or less hooked, flattened tails 1 in. long; petals yellow, very small. Colombia. B.M. 6977.—Odd and distinct.

42. **nycterìna,** Reichb. f. Often confused with *M. Chimæra,* but a smaller and less showy plant: tufted: lvs. oblanceolate, somewhat fleshy, channelled, 6 in. long, not narrowed into a petiole: peduncle 1-fld., 3 in. long, drooping: fl. triangular, 2 x 3 in., with tails 3 in. long, hairy inside, brown-yellow and purple-spotted; petals yellow, with red spots, pouch-like, serrate. Colombia. I.H. 20:117–18 (as *M. Chimæra*).—Odd.

43. **bélla,** Reichb. f. Lvs. oblong-lanceolate, channelled, about 8 or 9 in. long, narrowing to the base: peduncle 1-fld., drooping or horizontal, ½ ft. long, slender: fls. large and spider-like, triangular in outline, 3 in. across, with stiffish tails 4 in. long, of which the dorsal is recurved and the others standing forward and usually crossed, the fl. pale yellow, spotted with purplish or brown; petals white or yellowish. Colombia. Oct.–Dec.—One of the best of the Chimæras.



1375. Masdevallia Chimæra. (×½.)

44. **radiòsa,** Reichb. f. Lvs. oblong or lanceolate: peduncle 2–3-fld., drooping or deflexed: fls. yellow, dotted and splashed with purple, the prominent tails all purple; petals yellow, purple-spotted, but the lip whitish. Colombia.

SECTION V.

45. **triaristélla,** Reichb. f. Lvs. about 2 in. long, in very crowded tufts: peduncles longer than the lvs., very slender, erect, wiry: dorsal lobe of calyx ovate, hooded, tail yellow; lateral lobes coloring throughout their length, linear, united, at length diverging into short yellow tails; petals yellow, with a red midline. Summer. Costa Rica.—One of the smallest of orchids.

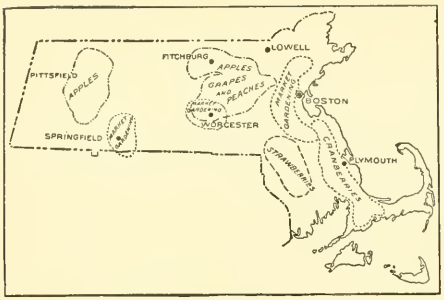
The following have been offered in America, but most of them are imperfectly known. *M. cheirophora.*—*M. Chêlsoni*=(M. amabilis×Veitchiana).—*M. gibberòsa*=Scaphosepalum.—*M. Hendersoni.*—*M. punctàta*=Scaphosepalum.—*M. tricàta.*

HEINRICH HASSELBRING and L. H. B.

MASSACHUSETTS HORTICULTURE. Fig. 1376. The horticultural interests of Massachusetts are fully equal to those of agriculture proper, when we consider the production of fruits, vegetables, flowers, and the labor and expense applied to the growth of ornamental trees, shrubs and plants and their use in decorating the homes of her people, among whom there are probably more comfortable, well-kept and beautiful homes than can be found in any similar area in the world. The people of this state probably consume more of the luxuries of life than any other people on the same area, and among the so-called luxuries may be classed fruits, fancy vegetables and flowers.

The soil of Massachusetts is generally considered unproductive and poorly adapted to horticultural pursuits, and this is true in so far as it refers to large areas of exceptionally fertile land, of which that in the Connecticut valley is the only section of more than a few acres in extent. Everywhere about the state, however, there are small areas of land suited to the growth of almost every crop succeeding in similar latitudes. By business enterprise, persistent effort and skill, profitable horticultural crops can be grown. The local products largely supply the markets in their season. Apples are also exported.

The amount of fruit produced within the limits of the state is not nearly up to the home consumption, except cranberries and possibly the apple in some seasons. Even



1376. Massachusetts.
Showing some of the leading horticultural areas.

in seasons of an unusual crop in the state, large quantities of apples from other states are shipped into our markets, because in many cases they are of superior size and beauty. Pears are shipped into our markets from the southern states and California, and as the market for this fruit is limited, prices often rule very low. Eastern Massachusetts is admirably adapted to pear-growing.

Peach trees can be grown up to about ten to fifteen years of age when given the proper attention, but the fruit buds are frequently killed in the winter, and not more than one crop may be produced in three years. However, even under these conditions, when the trees are planted on rather light land and well cared for, one crop in three years is often more profitable than most other fruit or vegetable crops. The fruit on trees properly cared for is large, of the finest color and quality, and the fresh, ripe condition in which the grower can put it into the local markets makes it quickly salable at the highest prices.

Plums are not grown to a great extent, the larger markets being supplied chiefly by New York and California. Few orchards remain productive longer than ten or twelve years, on account of the black-knot, leaf-blight and brown-rot. Within the past four or five years Japanese plums have been largely planted, but have borne little fruit up to this time, so that their status in the market is not fully established.

The cherry, owing to the attack of the black aphis, the plum curculio and brown-rot, is very little grown as an orchard fruit. A few vigorous and productive trees may be seen here and there by the roadside, about old homesteads or on the lawn, where they live longer and attain greater size than when grown under a high state of cultivation in the garden or orchard, because of the fact that when grown too rapidly the trunks crack on the south side and the trees soon die. Our markets are largely supplied with cherries from California, New York and other states.

Small fruits are more grown and more nearly supply local markets than do the large fruits. The supply of very early fruit comes from the southern states of the country, but home-grown fruit is so much superior in quality that it sells at reasonable prices, notwithstanding prices may have been very much reduced by an oversupply of the southern product. Of the smaller fruits, grapes are profitable mostly when grown on rather light land and at high elevations with a southern exposure. The chief obstacles to success are early frosts in the fall and late frosts in the spring. Currants are grown to a considerable extent, almost every garden containing more or less currant bushes for home supply, while many large plantations may be found near every large town or city. The conditions of success are a rather moist, rich soil, with the bushes trained into a very compact form and pruned so that the fruit will be borne on wood that is not over three or four years old. Gooseberries are little grown, although the demand is rather on the increase. The more hardy kinds can be as easily grown as the currant, while the European sorts and their hybrids, many of them, require much care and skill. Like the currant, the blackberry is largely grown for home use, and also for market. It succeeds upon a great variety of soils, can be grown cheaply and sells at good prices. Few plantations will be profitable on the same land more than from five to seven years unless the soil is strong and rich. It is the practice of most growers to plant a new lot every six or seven years. The red raspberry is the most popular of the bush fruits, and when successfully grown is the most profitable. For success it requires a deep sandy loam, retentive of moisture, but plantations must be renewed after six or eight years' growth on one piece of land. The black-cap raspberry has found less and less of favor each year with our people, and can only be sold at very low prices in our city markets.

The business of market-gardening has made rapid strides in the state in the past ten years, and the demand for choice vegetables continues more or less the year round. Even in the matter of competition with vegetables from the South during the winter, our local growers have reached a good degree of success. In almost every part of the state may be found forcing-houses for the growth of lettuce, tomatoes, cucumbers, rhubarb, asparagus, etc., and notwithstanding the cost of such structures and the fuel to keep up the necessary heat, the increase in the number of forcing-houses within the past two years is a certain indication that the business is profitable.

It is perhaps in the growth of cut-flowers and house and decorative plants that this state excels in horticulture. As a rule, the largest establishments of this kind are located near the large cities, though in some cases they may be found in some of the more rural towns. The horticulturists of Massachusetts do not understand their advantages in having the best markets in the world at their doors, and a great variety of soils suitable for the growth of many of the varied crops. By persistent effort and superior skill they could supply these markets largely, and thus retain within the state much of the wealth that now goes outside to pay for the produce that could be raised at home. S. T. Maynard.

In commercial horticulture, Massachusetts is not the equal of some other states, although its market-gardening and floricultural interests are large, but its influence on the horticulture of the country is more important than acres and tonnage. The best horticulture is that which develops under difficulties, because it develops the man. The love of the country and attachment to its own soil are strong in Massachusetts. Individuality has full course. It is a land of home-loving people. It has developed the amateur horticulturist to perfection,—the person who grows the plant and dresses the soil for the very love of it. There are many large collections of choice plants, and great numbers of artistic, compact and tidy garden-homes. There is keen appreciation of the merit of well-grown things. The influence of the Massachusetts Horticultural Society has been incalculable. Since 1829 it has had its stated discussions, held its periodical shows, collected its library and records. It is a center of education and culture. The establishment of Mt. Auburn cemetery in 1831 was the beginning of the movement in this country for cemeteries in the open as distinguished from the churchyard. L. H. B.

MASSÁNGEA comprises one species (*M. musaica*, Morr.), which is now referred to Guzmania, **G. musàica**, Mez. It is not known to be in the Amer. trade, although it is cult. in the Old World. It is from Colombia. It is stemless, with 20 or less broad-strap-shaped, entire-edged lvs., which are marked transversely with purple, and a head of small fls. (corolla shorter than calyx) which are covered by very showy red bracts. B.M. 6675. I.H. 24:268.—Known also as a Tillandsia, Billbergia, Caraguata and Vriesia.

MAST. English name for beechnuts; American for any woods-nuts eaten by swine.

MATRICÀRIA (*mater*, mother, from its use in diseases). *Compósitæ*. From Chrysanthemum it differs mostly in the akenes, which are 3-5-ribbed on the interior

face and ribless ou the back; also in having a higher or more conical receptacle, and bracts in few rather than many series. Matricarias are annual or perennial weedy herbs, often heavily scented, about 25 species in many parts of the world. The foliage is much cut or divided into thread-like divisions.

The Matricarias are border plants in cultivation, and others are introduced weeds. They are commonly confounded with species of Chrysanthemum and feverfew. The *M. eximia plena* of the trade is a form of *Chrysanthemum Parthenium* (var. *tubulosum*). It is a good hardy annual, with white, double heads, growing 2 ft. tall. Matricarias demand the care given to annual Chrysanthemums. The twe following are annuals or biennials.

inodòra, Linn. (*Chrysánthemum inodòrum*, Linn. *Pyrèthrum inodòrum*, Smith). Nearly or quite glabrous, branchy diffuse annual, 1–2 ft. tall, from Europe and Asia. Lvs. many, sessile, 2–3-pinnately divided or dis-seeted: heads 1½ in. across, terminating the branches, with many acute white rays: akenes inversely pyramidal, with 3 conspicuous ribs. Not uncommon in fields eastward. Var. **plenissima,** Hort. (var. *ligulòsa*, var. *multiplex*, *M. grandiflòra*, Hort. not Fenzl.), is a common garden plant with very double, clear white, large heads. It is floriferous, and the fls. are fine for cutting. G.C. II. 12:753.—It often persists and blooms the second year. Foliage little or not at all scented.

parthenoides, Desf. (*M. Capénsis*, Hort., not Linn. *Anthemis parthenoides*, Bernh. *Chrysánthemum parthenoides*, Voss). Annual, or biennial under cultivation, 2 ft. or less high, soft-hairy when young, but becoming smooth, bushy in growth: lvs. petiolate, twice divided, the ultimate segments ovate and often 3-lobed: fl.-heads loosely corymbose, in the garden forms usually double, white.—A handsome plant, probably of Old World origin, useful for pots, and blooming till frost.

Other introduced species from Eu. are *M. Chamomilla*, Linn., a glabrous, much-branched annual, with finely dissected lvs., 10–20 truncate white rays, and an oblong, nearly terete akene with 3–5 faint ribs; and *M. discoidea*, DC. (M. matricarioides, Porter), a very leafy and glabrous annual with no rays and a lightly nerved oblong akene. L. H. B.

MATRIMONY VINE. See *Lycium*.

MATSÈA. Consult *Manettia*.

MATTEÙCCIA (from C. Matteucci, an Italian physicist). *Polypodiàceæ*. A small genus of north temperate ferns, with leaves of two sorts, the sterile growing in crowns from erect rootstocks, and the fertile growing from the interior of the crown. Our species is known as the Ostrich Fern and is one of the most easily cultivated, as well as one of the handsomest of our native species. It multiplies rapidly by offsets sent out from the rootstock. Commonly known as an Onoclea or Struthiopteris.

Struthiòpteris, Todaro (*Struthiópteris Germánica*, Willd. *Onoclèa Struthiópteris*, Hoffm.). Ostrich Fern. Lvs. (sterile) 2–6 ft. long, with the lowest pinnæ gradually reduced; fertile lvs. 10–15 in. long, pinnate, with the margins of the pinnæ closely inrolled and covering the sori. Eu. and northeastern N. Amer.—Wildenow regarded the American species distinct, but by most botanists it is considered as identical with the European species. L. M. Underwood.

MATTHÌOLA (Peter Andrew Matthioli, 1500–1577, Italian physician and writer on plants). Sometimes spelled *Mathiola*. *Crucíferæ*. Stock. Gilliflower, when used at the present day, means Matthiola or sometimes Cheiranthus; formerly it designated *Dianthus Caryophyllus*. From Cheiranthus, the wallflower, this genus differs in its winged seeds, which are as broad as the partition, the stigma lobes erect or connivent and often thickened on the outside, the silique not 4-sided (terete or compressed). Of Matthiolas there are probably 30 species, widely distributed in the Old World and Australia. They are herbs or subshrubs, tomentose, with oblong or linear-entire or sinuate lvs., and large, mostly purple fls. in terminal racemes or spikes.

The true Stocks (Fig. 1377) are of this genus. The Virginian Stocks are diffuse small-flowered annuals of the genus Malcomia (which see). Stocks are of two general types,—the autumn-blooming, Queen or Brompton Stocks, and the summer-blooming, Ten Weeks or Intermediate Stocks. By some persons these classes are made to represent two species—*M. incana* and *M. annua* respectively. It is probable, however, that they are garden forms of one polymorphous type. Even if distinct originally, it is not possible now to distinguish them by definite botanical characters. Stocks are amongst the most common of all garden flowers. The two types cover the entire blooming season, particularly if the earlier ones are started indoors. Most of the garden forms are double, although some of the single types are desirable for the definiteness and simplicity of their outlines. The colors are most various, running from white through rose, crimson, purple and particolored. The fls. are fragrant. For culture, see *Stock*.

1377. Ten Weeks' Stock—Matthiola incana, var. annua (×½).

incàna, R. Br. Common Autumnal or Brompton Stock. Biennial or perennial, becoming woody at base, but usually treated as an annual: erect-branching, closely tomentose-pubescent, the stems stiff and cylindrical: lvs. alternate, tapering into a petiole, long-oblong or oblanceolate, entire, obtuse: fls. with saccate lateral sepals and large petals with long claws and wide-spreading limb, borne on elongating stalks in an open, terminal, erect raceme: siliques becoming 3–4 in. long, erect. Mediterranean region; also Isle of Wight. —*M. glabràta*, DC., is a glabrous form.

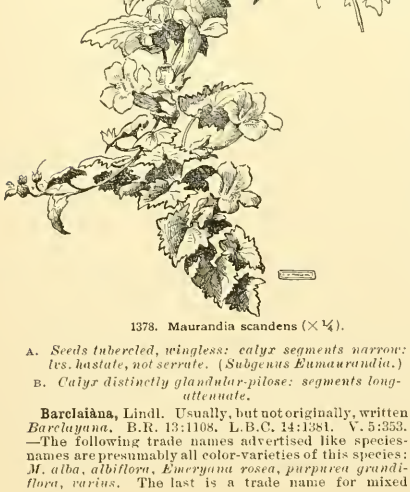
Var. **ánnua,** Voss (*M. ánnua*, Sweet). Ten-Weeks, or Intermediate Stocks. Fig. 1377. Annual, less woody, blooming earlier.—A shining-lvd. variety is known.

bicórnis, DC. Half-shrubby, straggling annual or biennial: fls. smaller than those of *M. incana*, purplish or lilac, fragrant by night, closing by day: pod terete, long, 2-horned: lvs. pinnatifid, or the uppermost entire. Greece, Asia Minor.

M. sinuàta, var. *Oyénsis*, Rouy & Foue., is figured in B.M. 7703 (1900), where it is said that "the name Oyensis has been corrupted in gardens to Ohiensis and Chinensis." The plant is from the Ile d'Yeu (Insula Oya, whence the name) on the coast of France. It is an annual or biennial, with sinuate-toothed lvs., hairy, and with large white fragrant fls. Not known to be in cult. in this country. L. H. B.

MAURÁNDIA (after Maurandy, professor of botany at Cartagena, Spain). Also written *Maurandya*. *Scrophulariàceæ*. About 5 species of Mexican climbers, with usually halberd-shaped lvs. and showy, irregular trumpet-shaped fls., white, rose, purple and blue, the throat usually white or light-colored. The fls. are somewhat 2-lipped. The commonest species is *M. Barclaiàna*, which is procurable in a greater range of colors than the others. Maurandias are desirable vines for winter-flowering in cool greenhouses, but since they bloom the first year from seed, they are almost wholly grown for summer bloom outdoors and treated like tender annuals. They have a slender habit and grow about 10 ft. in a season. In the fall the vines may be taken up and removed into the house if desired.

Botanically, this genus is nearest to the snapdragon, though the throat of the flower is not closed. The plant known to the trade chiefly as *Maurandia antirrhiniflora* is now referred to Antirrhinum. (See *Antirrhinum*, where this plant is figured.) It is a climber and requires the culture of Maurandias. Maurandias climb by the twisting of the leaf- and flower-stalks. They are glabrous or pubescent: lvs. alternate, the lower ones opposite, halberd-shaped, angular-lobed or coarsely toothed: calyx 5-parted; segments narrow or broad: corolla tube scarcely bulged at the base; posterior lip 2-cut; anterior lip variously parted: stamens 4-didynamous.



1378. Maurandia scandens (×¼).

A. *Seeds tubercled, wingless: calyx segments narrow: lvs. hastate, not serrate.* (*Subgenus Eumaurandia.*)

B. *Calyx distinctly glandular-pilose: segments long-attenuate.*

Barclaiàna, Lindl. Usually, but not originally, written *Barclayana*. B.R. 13:1108. L.B.C. 14:1381. V. 5:353. —The following trade names advertised like species-names are presumably all color-varieties of this species: *M. alba*, *albiflora*, *Emeryana rosea*, *purpurea grandiflora*, *varius*. The last is a trade name for mixed varieties.

BB. *Calyx glabrous, shorter.*

sempérflorens, Ort. Fls. lavender-colored; throat white. B.M. 460.—Cult. in S. Calif.

AA. *Seeds with a lacerated or irregular wing: calyx segments leafy and broad: lvs. triangular-ovate, serrate.* (*Subgenus Lophospermum.*)

B. *Corolla lobes obtuse or even notched.*

erubéscens, Gray. Lvs. somewhat triangular in outline, serrate: fls. 3 in. long, rosy pink. B.M. 3037, 3038. B.R. 16:1381. G.C. II. 20:501.—Cult. in S. Calif.

BB. *Corolla lobes acute.*

scándens, Gray (*Lophospérmum scándens*, D. Don). Fig. 1378. Perhaps only a botanical variety of the preceding. B.M. 3650.—A hybrid with the preceding is shown in B. 5:242. W. M.

MAURÍTIA (after Prince Moritz, of Nassau, 1567–1665, patron of Piso and Marcgraf; by his aid a Natural History of Brazil was published). *Palmàceæ*. Very graceful fan palms, almost spineless: stems very slender, obscurely ringed: lvs. pinnately flabelliform, semi-circular, orbicular or wedge-shaped, the lobes lanceolate, acuminate; rachis long or short; petiole cylindrical: ovary perfectly 3-celled. There are 6 or 7 tropical American species.

flexuósa, Linn. f. MORICHE PALM. Stems without stolons: lvs. 20–30, erect-spreading, 9–16 ft. long; blade 2½–4 ft. long, yellowish beneath; lobes ⅔–1¼ in. wide; petiole stout, rigid, semi-cylindrical, equaling the blade: fr. nearly 2 in. long, depressed-globose; seed 1⅓ in. long. Trop. Brazil.—Offered in 1889 by Reasoner Bros. In the Amazon delta this palm grows to 150 ft. or more in height, with a trunk often 30 in. in diam. at base. "The fruit is spherical, the size of a small apple, and covered with rather small, smooth, brown, reticulated scales, beneath which is a thin coating of pulp. A spadix loaded with fruit is of immense weight, often more than two men could carry between them.—*Wallace*, "Palms of the Amazon." JARED G. SMITH.

MAXILLÀRIA (Latin, *maxilla*, jaw; referring to the mentum). *Orchidàceæ*. Mostly pseudobulbous, epiphytic orchids, resembling Lycaste in general appearance. The genus contains over 100 species, dispersed at various altitudes in Mexico, Brazil and the West Indies. About 15 species are offered by dealers in America. Many of these have small flowers and are of value only in collections. They are, however, easily grown, and blossom profusely. Among those given below, the large, white-flowered *M. grandiflora* and *M. eumystis*, and the white and purple *M. Sanderiana* are probably the best species. Rhizomes short or long, creeping or erect, and clothed with distichous lvs.: pseudobulbs clustered or scattered on the rhizome, 1–2-lvd. or densely distichophyllous at the apex of the rhizome: lvs. leathery or subfleshy, plicate or plane and keeled, distichous: sepals subequal, free from each other but united with the foot of the column and forming a projecting mentum; petals similar or smaller: labellum 3-lobed, movably articulated to the foot of the column: lateral lobes erect; middle lobe with longitudinal callosities. The scape arises apparently from the base of the pseudobulb, on the very young leafy axis, but lower down than the corresponding new growth. Pollinia 4, seated on a broad, scale-like stipe. The distichous arrangement of the lvs. distinguishes this genus from Lycaste. For *M. Harrisoniæ* and *tetragona*, see *Lycaste*.

HEINRICH HASSELBRING.

Maxillarias are of easy culture, and can be grown under various methods of treatment with fair success. The best compost consists of clean peat fiber taken from the several species of Osmunda, and live sphagnum, both chopped rather fine and well mixed together. After the receptacle is half filled with clean drainage and the plant properly placed, the compost should be pressed firmly in around the roots, interspersing it with nodules of charcoal. In their native habitats, many of the fine-rooted species grow on rocks and trees with very little compost attached. The base of the pseudobulbs or rhizome should rest on a convex surface raised a little above the

rim of the pot when finished. Maxillarias delight in a cool, moist, shaded location at all seasons where the winter temperature will not exceed 58° F. by night and not over 60° or 65° by day. During summer they must be grown as cool as possible with ventilation at all seasons when admissible, especially in wet, heavy weather. Water should be given in abundance while the plants are growing and not too sparingly when at rest, as the plants are subject to spot if kept too dry. Weak liquid cow manure is beneficial occasionally during root action.

Maxillaria has two recognized horticultural groups or sections; viz., caulescent and stemless. The caulescent section embraces *M. tenuifolia*, *M. variabilis* and kindred species, having scandent rhizomes and often obscure flowers. These should all be grown under pot culture and afforded supports to climb on, such as small cylinders or rafts of open woodwork with a little compost worked in the openings, or Osmunda rhizomes supported obliquely in the pots to which the plants can attach themselves as they grow upward, and thus be supplied with moisture for the young roots. To the stemless section belong those with clustered pseudobulbs, as *M. fuscata*, *M. grandiflora*, *M. luteo-alba*, *M. picta*, *M. Sanderiana* and *M. venusta*. Some of these have very showy flowers. Nearly all do best under pot-culture. *M. Sanderiana* and others are exceptions, however, and grow best under basket culture, not too much compost and an airy position. Demand for Maxillarias not being great, the market usually relies on new importations, but stock may also be increased by division between the pseudobulbs as the plants start new action.

ROBERT M. GREY.

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A. *Pseudobulbs clustered on the creeping rhizome.*
B. *Fls. mostly white, large and showy.*
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CC. *Sepals broad, ovate, triangular or oblong.*
D. *Middle lobe of the labellum tongue-like* ..... 2. **grandiflora**
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CC. *Sepals and petals dissimilar, the latter smaller*..... 8. **elegantula**
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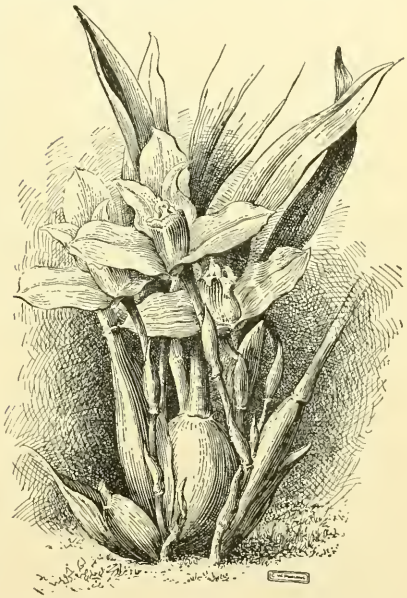
12. **variabilis**
13. **tenuifolia**

1. **venùsta**, Linden & Reichb. f. Pseudobulbs oblong, compressed, 2-lvd.: lvs. oblong-lanceolate, acuminate, plane, 1 ft. long; scapes 6 in. long, bearing a single glistening white fl. 6 in. across; sepals and petals long-lanceolate, acuminate, spreading; the lateral sepals wider, labellum much smaller; middle lobe triangular recurved, obtuse, yellow; lateral lobes very obtuse, bordered with red; disk with a rounded, hairy callus. Winter and spring. Colombia. B.M. 5296. G.C. III. 12:367 (abnormal).—A large-fld., showy species.

2. **grandiflòra**, Lindl. Fig. 1379. Pseudobulbs clustered, oval: lvs erect, plane, keeled, ovate-oblong, 1 ft. long: scapes erect, 3–6 in. long, bearing solitary, large white fls. 3–4 in. across; sepals broadly ovate to oblong; petals ovate acute, suberect, with recurved tips; labellum saccate, white, much-striped with purple on the sides; middle lobe tongue-like, white, bordered with yellow. Aug. Peru and Colombia. I.H. 17:14.—A very showy and beautiful plant.

3. **Lehmanni**, Reichb. f. Fl.-stalks nearly 1 ft. in length, bearing white fls. nearly as large as those of *Lycaste Skinneri:* side lobes of the labellum light ochre outside and light reddish brown with chestnut veins inside; middle lobe triangular, wavy, sulfur color. Ecuador.—Resembles *M. grandiflora*, but distinguished by the character of the lip.



1379. Maxillaria grandiflora (× nearly ½).

4. **Sanderiàna**, Reichb. f. Pseudobulbs orbicular to broadly oblong, 1–1½ in. long: lvs. few, 6–10 in. long, oblanceolate, plane, keeled: scapes 2–3 in. long: fls. 4 in. across, pure white, with the bases of the segments purplish red, broken upwards into blotches; dorsal sepals oblong-obtuse, concave; lateral sepals triangular-ovate, forming a broad mentum at base; lateral lobes of the labellum almost obsolete, middle lobe rounded, crisp, bright yellow, throat dark purple, with a club-shaped callus. Ecuador. B.M. 7518. R.H. 1894:526. J.H. III. 26:495.—The finest known species.

5. **Lindeniæ**, Hort. (*M. Lindeniàna*, Rich & Gal.?). Plants resembling *M. Sanderiana*, but the fls. larger and more open: sepals triangular-lanceolate, spreading, 3 in. long, pure white; petals shorter and wider, erect, white; labellum fleshy, obovate, somewhat crisp, recurved, pale yellow, with 5–6 red lines on the lateral lobes. S.H. I:219.

6. **picta**, Hook. (*M. fuscàta*, Klotzsch). Pseudobulbs 1½ in. high, ovate, furrowed, bearing 1–2 plane, strap-shaped lvs. 1 ft. long: scape 5–6 in. high: fls. nodding; sepals and petals oblong-linear, acute, incurved, deep orange spotted with purple within, white with deep purple spots outside; labellum oblong, whitish, spotted; side lobes small, rounded; midlobe recurved, apiculate. Winter. Brazil, Colombia. B.M. 3154. B.R. 21:1802.—Handsome.

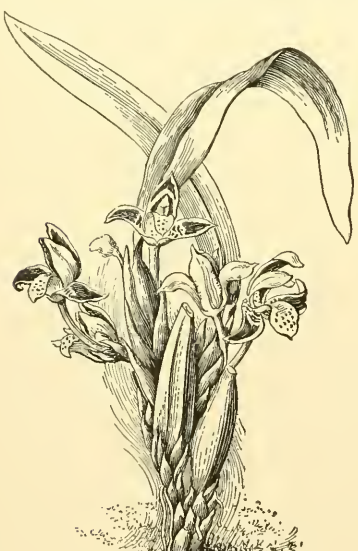
7. **rufèscens**, Lindl. (*M. fuscàta*, Reichb. f.). Pseudobulbs ovate, subtetragonal, 1-lvd.: lvs. lanceolate,

acuminate: scape short, with 1 small fl.: sepals and petals oblong obtuse, yellow-tinged and spotted with reddish orange; side lobes of labellum small, sharp; middle lobe elongate, sub-quadrate, emarginate; all yellow, spotted with crimson. Trinidad. B.R. 22:1848.—Not valuable.

8. **elegántula,** Rolfe. The bases of the segments are white, the outer halves pale yellow, marked with chocolate color. Nov. G.C. III. 22:420.—From the illustration, the sepals are ovate-lanceolate, wavy and recurved, the lower pair broader; petals smaller, pointing forward, concave, wavy, with reflexed tips: lvs. lanceolate-acute.

9. **lùteo-álba,** Lindl. Pseudobulbs long-ovate, 1-lvd., 2½ in. high: lvs. broad, obtuse, narrowed at the base, 1 ft. long: scapes 6 in. long: sepals 3 in. long, ½ in. wide, tawny yellow fading to white at the base, brown on the back, the lower pair drooping; petals erect, pointing forward, one-half as long, white to brown and yellow above; side lobes of the labellum yellow with purple streaks; middle lobe recurved, hairy, yellow, with white margins. Colombia.—A robust species, which soon fills large-sized pans, making very ornamental plants.

10. **striàta,** Rolfe. Scapes 6–8 in. long, bearing solitary fls. 4–5 in. across the sepals: dorsal sepals ovate-oblong; lateral sepals ovate-attenuate, forming a broad mentum at the base, often twisted and recurved; petals narrower, wavy; both sepals and petals are yellow, striped with red-brown; lobes of the labellum crenate-wavy, white with purple veins, the lateral ones recurved. Aug. Pern. G.C. III. 20:631. G.M. 41:705.



1380. Maxillaria Houtteana (× about ¼).

11. **Houtteàna,** Reichb. f. Fig. 1380. Rhizome erect or ascending, clothed with brown sheaths: pseudobulbs 2–2½ in. long, linear-oblong, compressed: lvs. solitary, 6 in. long, linear, obtuse, keeled: scape 1½–2 in. long: fls. nearly 2 in. across; sepals ovate-lanceolate, dirty yellow outside, red-purple within, with a yellow margin and spotted below; petals smaller, colored like the sepals; labellum without lateral lobes, oblong-obtuse, yellow with red-brown spots, and an ill-defined callus on the base. April. Guatemala and Venezuela. B.M. 7533.—Fls. last about a month in the coolhouse.

12. **variábilis,** Batem. (*M. angustifólia,* Hook.). Pseudobulbs oval, compressed: lvs. solitary, plane, linear-oblong, obtuse or emarginate: fls. solitary, small, deep purple; sepals linear-oblong, acute, the lateral ones produced at the base; petals subsimilar; labellum oblong, retuse, fleshy, membranous at the base: disk with a small callus. Midwinter. Mex. B.M. 3614 (as *M. Heuchmanni*).—A small plant, of interest only to collectors.

13. **tenuifólia,** Lindl. Rhizomes erect, bearing ovate-compressed pseudobulbs at irregular intervals: lvs. linear-lanceolate, acute, recurved, grass-like, plane: fls. small, spotted and shaded with purple and yellow; sepals ovate-lanceolate, margins revolute, reflexed; petals ovate, acute, erect; labellum oblong, reflexed, with an entire, oblong callus. Spring. Mex. B.R. 25:8.—Not valuable

M. dichròma, Rolfe. Allied to M. venusta, but the petals are suffused on the lower half with light pinkish purple, the lip being margined with the same color; sepals white. Grows freely in a coolhouse, the fls. lasting for a long time.

HEINRICH HASSELBRING.

MAXIMILIÀNA (after Maximilian Joseph, first king of Bavaria, 1756–1825, not Prince Maximilian Alexander Philipp, as said by some). *Palmàceæ.* Tall, pinnate-leaved palms, spineless, with ringed trunks: lvs. with linear pinnæ in groups, the midveins and transverse nerves prominent; rachis bifacial, strongly compressed; petiole plano-convex. This genus is distinguished from Attalea as follows: petals of the male fls. minute, much shorter than the 6 exserted stamens: fr. 1-seeded; pinnæ in groups instead of equidistant. From Cocos and Scheelia it differs in the above floral characters and in the plano-convex instead of concavo-convex petioles. Fr. yellow or brown, ovoid, with fibrous or fleshy pericarp and bony endocarp, the latter 3-pored at the base, acuminate at the apex. Species 3, St. Kitts, Trinidad and S. Am. For culture, see *Palms.*

A. *Pinnæ verticillate.*

Maripa, Drude (*Attalèa Maripa,* Mart.). Stem thick, very tall: lvs. 15 ft. long; segments ensiform acute, divaricate, the lower 3 ft. long, 2 in. wide, gradually diminishing upwards. Brazil.

AA. *Pinnæ in opposite clusters.*

règia, Mart. (*Attalèa amygdalina*). Fig. 1381. Stem 15–20 ft. high, 12–16 in. thick at the base, 3 times as thick above because of the persistent petiole bases: lvs. 15 ft. long; segments more slender, papery, disposed in opposite clusters, the upper as broad as the lower. Brazil. G.C. III. 1:232.

JARED G. SMITH.

MAY in English poetry refers to the flowers of the hawthorn, *Crataegus Oxyacantha.*

MAY APPLE. *Podophyllum.* See also *Passiflora.*

MAYBERRY, JAPANESE GOLDEN. Name proposed by Luther Burbank for *Rubus palmatus.*

MAYFLOWER of English literature is the same as the hawthorn, *Crataegus Oxyacantha;* of New England is *Epigæa repens;* of the more western states, *Hepatica.*

MAY-WEED. *Anthemis Cotula.*

MAYTÈNUS (from a Chilean name). *Celastràceæ.* A genus of about 50 species of trees and shrubs mostly from South America, some from tropical America. Botanically they are near our common bittersweet, *Celastrus scandens.* Aside from habit, Maytenus differs from Celastrus in having the ovary confluent with the disk instead of free, and the cells are mostly 1-ovuled instead

of 2-ovuled. Maytenus consists of evergreen, unarmed plants: lvs. alternate, often 2-ranked, stalked, leathery, serrate: fls. small, white, yellow or reddish, axillary, solitary, clustered or cymose; calyx 5-cut; petals and

1381. Maximiliana regia.

stamens 5, the latter inserted under the disk; disk orbicular, wavy-margined: style none or columnar: capsule leathery, loculicidally 2-3-valved.

M. Boaria is a beautiful evergreen tree, of graceful habit; in Calif. 15–25 ft. high, but in Chile said to attain 100 ft.: branchlets pendulous: lvs. small: fls. minute, greenish, inconspicuous: aril scarlet. Perfectly hardy in Calif. as far north as San Francisco, and highly valued for ornamental planting; recommended as a street and avenue tree: timber extremely hard. Propagated readily from seeds, which are produced in abundance, or from suckers.

Boária, Molina (*M. Chilénsis*, DC.). Mayten. Fig. 1382. Lvs. ovate-lanceolate, thin, glandular-serrate, glabrous: fls. small, axillary, clustered, polygamous, the males with 5 calyx teeth, petals and stamens: capsule the size of a pea, 2-valved, 2-seeded. Chile. B.R. 20:1702. J. Burtt Davy.

MAZE. See *Labyrinth.*

MEADOW BEAUTY. *Rhexia.* **M. Foxtail.** *Alopecurus pratensis* (a meadow grass). **M. Pink.** *Dianthus deltoides.* **M. Rue.** *Thalictrum.* **M. Saffron.** *Colchicum.* **M. Sweet.** *Ulmaria.* **M. Tulip.** *Calochortus.*

MECONÓPSIS (Greek, *poppy-like*). *Papaveràceæ.* About 10 species of herbs, natives of the Himalayas, China, Europe and western North America. The Welsh Poppy, *M. Cambrica*, is suitable for rockeries, grows about a foot high, and has rather large, pale yellow, 4-petaled fls. borne in summer. The genus is nearest to Argemone, but does not have prickly lvs. Perennial or rarely annual: lvs. entire or rarely lobed or dissected: fls. long-peduncled, yellow, purple or blue: ovary ovoid, with a short but distinct style and a stigma of 4–6 rays. J. B. Keller writes that the Welsh Poppy is of easy cultivation in ordinary garden soil and sunny situation, and is prop. by seed or division.

Cámbrica, Vig. Welsh Poppy. Perennial: stems slender: lvs. long-stalked, pale green, slightly hairy, pinnate, dentate, with 5–7 segments. Rocky woods and shady places, western Eu. G.C. III. 19:671 (a double-fld. form).

MEDÉOLA (named after the sorceress Medea, for its supposed great medicinal virtues). *Liliàceæ.* Indian Cucumber Root, from the taste of the edible root. This native perennial herb has 2 whorls of lvs. and bears small and not very showy fls. It is offered by some dealers in native plants. Medeola is nearest to Trillium. The fls. are umbellate, the perianth segments all alike, colored and deciduous.

Virginiàna, Linn. Fig. 1383. Stem slender, 1–3 ft. high, clothed with flocculent deciduous wool: lower whorl of lvs 7–9, obovate-lanceolate, pointed, netted-veiny, lightly parallel-ribbed, sessile; upper whorl of 3–5, smaller, ovate lvs. at top subtending a sessile umbel of small, recurved fls. June. Boggy soil, New England to Minn., Ind. and southward. B.M. 1316. D. 129.

M. asparagoides, Linn.—Asparagus medeoloides.

MEDICÀGO (name originally from the country Media). *Leguminósæ.* Forty to 50 herbs (rarely shrubs) in Europe, Asia and Africa, with small pinnately 3-foliolate lvs. and denticulate lfts., and mostly small, purple or yellow fls. in heads or short racemes; stamens 9 and 1, diadelphous: fr. a small spiral or curved, rough or pubescent indehiscent 1- to few-seeded pod: fl. with an obovate or oblong staudard and obtuse mostly short keel. Three or 4 species have become weeds in the East. A few are somewhat cult. for ornament. The one important species, from an agricultural point of view, is Alfalfa. One species (and perhaps more) is cult. for the odd pods, which are sometimes used by Old World gardeners as surprises or jokes, and are occasionally grown in this country as oddities. Some of the Medicagoes simulate clovers in appearance, but the twisted or spiral pods distinguish them.

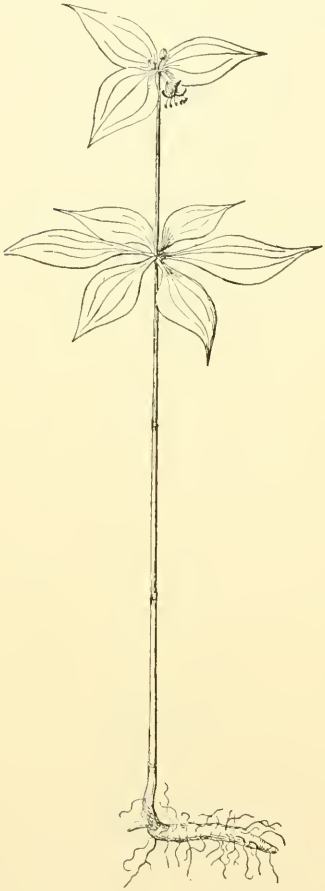
A. *Flowers purple.*

sativa, Linn. Alfalfa. Lucerne. Fig. 1384. Perennial, glabrous, growing erect 1–3 ft. and making a

1382. Maytenus Boaria.
Showing the dehiscing fruit.

long tap-root: lfts. small, linear, oblong to ovate-oblong, prominently toothed towards the top: stipules awl-like, conspicuous, entire: fls. in short, axillary racemes:

pods slightly pubescent, with two or three spirals. Eu. —Now widely cult., particularly in dry regions, as a hay and pasture, being to the West what red clover is to the Northeast. See *Alfalfa*. A hardier and drought-resisting race (known as var. **Turkestánica**, Hort.) was introduced from central Asia in 1898 by N. E. Hansen,



1383. Medeola Virginiana, the Indian Cucumber Root. (×½.) (See p. 997.)

under the auspices of the U. S. Dept. Agric. (see Hansen, Amer. Agric. Feb. 24, 1900; Circular 25, Division of Agrostology, U. S. Dept. Agric.).

AA. *Fls. yellow.*

B. *Plant annual and herbaceous.*

lupulìna, Linn. Black or Hop Medick. Nonesuch. Diffuse, the branches often rooting and becoming 2–3 ft. long, deep-rooted, and difficult to pull up: plant glabrous or slightly pubescent: lfts. oval to orbicular, toothed: stipules broad and toothed: fls. small, light yellow, in pedunculate heads: fr. nearly glabrous, spiral, becoming black. Eu.—Extensively naturalized. Has the appearance of a clover. The yellow clovers with which it is likely to be confounded have larger heads, which soon become dry and papery, and the stipules are entire. It is sometimes used as a forage or hay plant. Of no ornamental value.

1384. Medicago sativa—Alfalfa. (×½.)

prostràta, Jacq. Stem prostrate: lfts. linear, dentate at the apex: stipules linear-subulate: pod glabrous, spirally contorted, 2-seeded, black. S. Eu. —Advertised as an ornamental plant. *M. elegans*, a name for a low, yellow-fld. species, is also in the trade; it may be any one of 4 or 5 species.

scutellàta, Mill. Snails. Erect or spreading, soft-pubescent: lfts. broadly obovate or the upper ones broadly oblong, prominently toothed: stipules falcate, toothed at the base: fls. small, solitary or nearly so: pod large and prominently reticulated, ½ in. across, like a snail shell. Eu.—Grown for the odd snail-like pods, which are used as surprises. See the article *Caterpillars* and *Worms*.

BB. *Plant perennial and woody.*

arbòrea, Linn. Tree Alfalfa. Moon Trefoil. Two to 8 ft. tall, with hard black wood: lfts. oval to obovate, light green, toothed at the top: stipules linear-acute, entire: fls. orange-yellow, in rather loose, axillary, pedunculed clusters: pod spiral, 2–3-seeded. S. Eu. L.B.C. 14:1379.—Offered as an ornamental plant in S. Calif.

L. H. B.

MEDICK. See *Medicago*.

MEDINÍLLA (after José de Medinilla y Pineda, governor of the Ladrones). *Melastomàcea*. A genus of 98 species of tropical plants, mostly from the East Indies and Pacific islands. *M. magnífica* is one of the most gorgeous tropical plants in cultivation, and one of the most desirable for amateurs who have hothouses. It is a native of the Philippines. It has handsome broad, shining, leathery foliage and coral-red, 5-petaled fls., each about 1 in. across, which are borne in pendulous pyramidal panicles sometimes a foot long, and bearing 100–150 fls. The axis and branches of the panicle are pinkish, and the same color tinges the large, showy bracts, which are sometimes 4 in. long. Hooker says: "Its most beautiful state is, perhaps, before the full perfection of the fls., when the large imbricated bracts begin to separate and allow the buds to be partially seen. As the expansion of the blossoms advances, the upper bracts fall off, but the lower ones remain and become reflexed." This truly magnificent plant flowers copiously when only 2 or 3 ft. high, and a large well-kept specimen in flower is a sight that is never to be forgotten. The numerous long, bent, purple anthers, with their yellow filaments, form an additional feature of interest.

Medinilla is distinguished from allied genera (none of which has garden value) chiefly by the curious appendages of the stamens. The stamens are 8, 10 or 12, the anterior connective, 2-lobed or 2-spurred, the posterior one usually setose or 1–2-lobed or 1-spurred. Medinillas are branching shrubs, erect or climbing: lvs. mostly opposite or whorled, entire, fleshy: fls. white or rose, with or without bracts, in panicles or cymes. Cogniaux in DC. Mon. Phan. 7:572–602 (1891). The 2

species described below are glabrous, with opposite, sessile lvs. and long, terminal, pendulous, bracted panicles, with floral parts in 5's.

A. *Fls. coral-red or rosy pink.*

magnífica, Lindl. Figs. 1385–6. Lvs. with 9–13 nerves, which run from various points along the midrib to the margin or apex, ovate or ovate-oblong: bracts 1–4 in. long. Philippines. B.M. 4533. F.S. 6:572 and 9:968 (splendid). Gn. 51, p. 394. G.C. II. 2:421. R.H. 1857, pp. 319, 343, and 1896, pp. 102, 103. A.F. 7:1047.—Other interesting features are the whorled branches, each one 4-ridged or winged, and the dense ring of short, fleshy processes at the joints between the lvs. It can be propagated by seeds or cuttings of young wood in heat.

AA. *Fls. white.*

Cúrtisii, Hook. Lvs with 2 nerves beside the midrib which run from the base to the apex of the leaf: bracts about 3 lines long. Sumatra. B.M. 6730. G.C. II. 20:621.—John Saul says it blooms in autumn. W. M.

Medinilla magnífica is a fine stove plant, even when not in flower. It remains in bloom from April to July. The writer has kept a tree-shaped specimen for more than twenty years, during which time it has never failed to bloom annually. In alternate seasons the fls. have been more abundant, showing that the plant needs a rest. After flowering, the specimen may be placed outdoors in a partly shaded position, where high winds cannot damage the foliage. In September, it should be placed in a conservatory with a night temperature of 55°. When growing vigorously it likes plenty of weak liquid cow manure and guano alternately. It must be constantly watched for mealy bug, as it is almost impossible to dislodge this pest after the racemes have begun to form. F. L. Harris.

1385. Medinilla magnifica. A young specimen.

1386. Medinilla magnifica (×⅓).

MEDLAR. See *Mespilus.* The Loquat is sometimes erroneously called Medlar. For Japanese Medlar, see *Photinia.*

MEDUSA'S HEAD. *Euphorbia Caput-Medusæ.*

MEGARRHÍZA (Greek for *big root*). *Cucurbitàceæ.* By Bentham & Hooker, and also by Cogniaux (DC. Monogr. Phaner. 3) this genus is referred to Echinocystis, but Watson (Bot. Calif. 1, p. 241) distinguishes it from that genus "by its thick perennial roots, its large, turgid, immarginate seeds and its thick, fleshy cotyledons which remain under ground in germination. The fruit in some species appears to be wholly indehiscent." There are five species described in the Botany of California. One of these, **M. Californica,** Torr. (*Echinocystis fabacea,* Naud.), is sometimes grown in fine collections and botanic gardens. It is a tendril-climber, reaching 20 to 30 ft. in its native haunts: lvs. deeply 5–7-lobed: fls. monœcious: fr. densely spinose, globose or ovoid, 2 in. long: seed obovoid, nearly 1 in. long and half or more as broad, margined by a narrow groove or dark line. S. Calif. Odd in germination (see Gray, Amer. Jonrn. Sci. 1877).

MEGASÈA. See *Saxifraga.*

MELALEÙCA (Greek, *melas,* black, and *leukos,* white; from the black trunk and white branches of one of the species). *Myrtàceæ.* This genus comprises abont 100 species of Australian trees and shrubs, many of which are considered useful for fixing coast sands and holding muddy shores. The trees live in salty ground and water, much as mangroves do, and some are grown in swamps as a corrective of fever conditions. They transplant easily and have close-grained, hard, durable timber. Lvs. alternate, rarely opposite, entire, lanceolate or linear, flat or snbterete, with 1–3 or many nerves: bracts deciduous: fls. in heads or spikes, each sessile in the axil of a floral leaf, their parts in 5's; calyx tube subglobose; lobes imbricate or open; petals spreading, deciduous; stamens indefinite in number, more or less united at their bases into 5 bundles opposite the petals; anthers versatile, the cells parallel and bursting longitudinally: ovary inferior or half inferior, enclosed in the calyx tube, usually with many ovules in each cell. Several species are cultivated in S. Calif. Sometimes called Bottle-brush trees, from their resemblance to the allied Callistemons. Flora Australiensis, 3:123.

A. *Lvs. mostly alternate.*

Leucadéndron, Linn. (*M. Cajaputi,* Roxb.). The Cajaput Tree. The most widely distributed of all the

species, with many changeable and uncertain variations, found throughout tropical Asia, especially the Indian Archipelago. The plants range in size from shrubs to trees 80 ft. high, the large trees having slender, pendulous branches, the small trees and shrubs rigid, erect branches: lvs. often vertical, elliptical or lanceolate, straight, oblique or falcate, acuminate, acute or obtuse, when broad 2–4 in. long, when narrow 6–8 in. long, narrowed into a petiole, thin or rigid: fl.-spikes more or less interrupted, solitary or 2 or 3 together, from less than 2 to more than 6 in. long: fls. numerous, white, elongated; stamens greenish yellow, whitish, pink or purple, glabrous, 5–9 in each bundle, less than ½ in. long; claws sometimes very short, sometimes exceeding the petals, each with 5–8 filaments at the end. The lvs. yield the well-known green aromatic cajaput oil used in medicine. The bark is pale buff, in many thin, easily separated layers; it is very durable, lasting longer than timber, and is said to be almost impervious to water; it is valuable for packing fruits and is used for roofs and for boats. The tree withstands winds, drought and slight frosts and grows where the Eucalyptus fails. Von Müller recommends it for planting where yellow fever occurs. Sometimes called the Paper Bark or Swamp Tea tree. G.M. 40:798.

AA. *Lvs mostly in whorls of 3–5.*

micromèra, Schau. Lvs. closely appressed, ovate, scale-like, but thick, peltately attached, rarely above ½ line long: fls. sulfur-yellow, the males small, in globular, terminal heads, the axils soon growing out into a leafy shoot: fruiting heads dense, globular, the calices open.

AAA. *Lvs. mostly opposite.*

B. *Margins of lvs. recurved.*

hypericifòlia, Smith. Lvs. opposite, lanceolate or oblong, rather thin, with recurved margins and prominent midrib ¾–1½ in. long: fls. large, rich red, in cylindrical or oblong dense spikes; stamens over ½ in. long; staminal claws long. L.B. C. 2:199.—This species belongs to a series in which the stamens are over ½ in. long, while in the other 6 series the stamens never exceed ½ in.

BB. *Margin of lvs. not recurved.*

decussàta, R. Br. Tall shrub, sometimes 20 ft. high: lvs. mostly opposite, often decussate on the smaller branches, oblong-lanceolate or linear, 3–6 lines long, rigid: fls. rather small, pink; when in oblong or almost globular lateral heads or spikes are usually barren, and fertile when in oblong or cylindrical interrupted spikes forming the base of leafy branches; stamens not above 3 lines long, very shortly united in bundles of 10–15; calyx lobes more or less scarious and deciduous or wearing off when in fruit, attached by the broad base, more or less immersed when in fruit in the thickened rachis. B.M. 2268. L.B.C. 13:1208. M. B. Coulston.

MELÁNTHIUM (Greek, *black flower;* from the darker color which the persistent perianth assumes on fading). *Liliàceæ.* Leafy perennial herbs 2–5 ft. high, with thick rootstocks: lvs. linear to oblanceolate or oval: fls. greenish, white or cream-colored, borne in a large, open terminal panicle. The genus is nearest to Veratrum, but the sepals of the latter are not clawed as they are in Melanthium. Perianth segments usually oblong or oblanceolate, with or without glands at the top of the claw. Of 6 species, 2 are African, 1 Siberian and 3 North American, only 1 of the latter being in the trade.

Virgínicum, Linn. Bunch Flower. Stem rather slender, leafy: lvs. linear, 1 ft. or less long: panicles 6–18 in. long: fls. 6–10 lines across; double gland at top of claw. July. Marshy woodlands and meadows from New England to Fla. and Minn. to Tex. B.M. 985 (*Helonias Virginica*).—Int. by H. P. Kelsey 1891. A showy and striking plant.

M. júnceum is advertised by Krelage, of Haarlem, but its botanical position is to be determined.

MELASPHÆRULA (a little black sphere; referring to the bulblets on the stem). *Iridàceæ.* A genus of one species from the Cape of Good Hope, a small, rare bulbous plant procurable from Dutch bulb-growers. It belongs to the Ixia tribe, in which the flowers are spicate, not fugitive, and never more than 1 to a spathe. It resembles Ixia in having a regular perianth and simple style branches, but belongs to a different group of genera in which the stamens are one-sided and arched. Baker places it between Crocosma and Tritonia, differing from them in having a small perianth without any tube and very acuminate segments. Baker, Irideæ, 1892, and Flora Capensis, vol. 6. For culture, see *Bulbs* and *Ixia.*

graminea, Ker. Corm globose, ½ in. in diam.: stem very slender, 1 ft. or more long: lvs. about 6 in a 2-ranked, basal rosette, linear, ½–1 ft. long: spikes few-fld., panicled: fls. yellowish green, veined with purplish black, ½–¾ in. across. Spring. B.M. 615.

1387. Umbrella-tree—Melia Azedarach, var. umbraculiformis.

MELASTÒMA (Greek for *black* and *mouth;* alluding to the color left in the mouth when the berries of some species are eaten). This genus, which gives name to the great family Melastomaceæ, with 2,000 species, is little known in cult. It is not the most important genus of the family, either horticulturally or in number of species. Cogniaux, the latest monographer (DC. Monogr. Phaner. 7), admits 37 species. The larger part of melastomaceous plants are of tropical America, but the true Melastomas are natives to tropical Asia, Australia and Oceanica. They are shrubs or rarely small trees: lvs. opposite, petiolate, oblong or lanceolate, thick and entire, strongly nerved lengthwise, often handsomely colored: fls. solitary or fascicled on the ends of the branches, purple or rose (rarely white), large and showy; calyx mostly 5-lobed; petals usually 5 and often unequal, ciliate on the back; stamens 10 as a rule, very strongly unequal, part of them being short and small: fr. a leathery or fleshy berry, breaking irregularly, 5–7-loculed and containing many small spiral seeds. For culture, see *Medinilla.* Nearly all tropical melastomaceous plants require a high temperature, partial shade and considerable moisture. Prop. by cuttings of firm wood. Advertized in S. Calif.

A. *Lvs. strongly 5-nerved.*

decémfidum, Roxbg. (*M. sanguíneum,* D. Don. *M. Malabáthricum,* Sims, not Linn.). Three to 4 ft.: branches subterete and hirsute: lvs. lanceolate or lance-oblong, long-acuminate, the nerves (or at least some of them) and the petioles often red: fls. 1–3, large, nearly or quite 2 in. across, the petals rose-colored and retuse. Java to China. B.M. 529 and 2241.

AA. *Lvs. strongly 7-nerved.*

cándidum, D. Don (*M. Malabáthricum,* B.R. 8:672, not Linn.). Branches 4-angled, the younger ones pubescent, as also the petioles: lvs. ovate-acute, setulose above, villose beneath: fls. 3–7 in a cyme, rose-colored (sometimes white?), about the size of those of *M. decemfidum;* calyx-lobes shorter than the tube. China.

Malabáthricum, Linn. Differs from the last in having the calyx-lobes about equal to the tube, or sometimes even longer: lvs. oblong or ovate-oblong, acute or short-acuminate, sparsely setulose, above and beneath: fls. corymbose, purple, much smaller than in the last two.

E. India to Austral.—Probably the *M. Malabathricum* of horticulturists is one of the above species. Not known to be in the Amer. trade. L. H. B.

MÈLIA (ancient Greek name). *Meliàceæ*. Trees, from 30 to 40 feet high: lvs. deciduous, doubly pinnate as a rule, the lfts. acuminate, glabrous: fls. in graceful panicles; sepals 3–5; petals 5 or 6; stamens monadelphous, 10–12, of two different lengths: ovary with several locules, topped with a single style: fr. a small, indehiscent drupe. Species 2 or 3, of Asia and Australia.

A. *Lvs. more than once-pinnate.*

Azédarach, Linn. This is the typical species as introduced in the southern states early in the last century. It is a native of India and Persia, hence its various local names, as Pride of India, Indian Lilac, Chinaberry tree, etc. It has become naturalized throughout the South, the seeds germinating freely. It grows with great rapidity, and forms one of the most desirable shade trees, both from the bright green tint of the foliage, which is retained until late in the autumn, and also from the fragrance of the numerous, lilac-colored flowers, which are produced during April. These are succeeded by an abundant crop of berries, of a yellowish, translucent color, which are readily eaten by cattle and birds. The wood, although coarse, is very durable. The tree can withstand a low temperature, but a cold of zero will injure it. Several forms have been found, a white-flowering and one with finely-cut leaves, with the segments of the lfts. cut in narrow divisions. These forms are not constant, the seedlings frequently reverting to the typical species. In all forms of *M. Azedarach*, the lvs. are 2- or 3-pinnate, the ultimate lfts. ovate or lanceolate, and varying from serrate to very nearly entire. B.M. 1066.

Var. **umbraculifórmis,** Hort. Texas Umbrella Tree. Fig. 1387. The first tree that came to notice was found

1388. Melicocca bijuga (sprays ×¼).

near the battle-field of San Jacinto, Texas, but with no record of its introduction there. If the flowers are not cross-pollinated with the common sort, the percentage of seedlings which reproduce the exact umbrella shape seldom varies; hence it is supposed by some to be a distinct species. The lfts. are less broad than in *M. Azedarach*, and the branches erect, and, in a manner, radiating from the trunk, the drooping foliage giving the tree the appearance of a gigantic umbrella. Mn. 8, p. 73.

AA. *Leaves once-pinnate.*

Azadirächta, Linn. (*M. Japónica*, Hassk.). Large tree, sometimes 50 ft.: lvs. broad, with 9–15 lanceacuminate, oblique, more or less serrate lfts.: fls. white, fragrant: foliage crowded near the ends of the branches. India.—Not hardy in the Middle South.

M. floribúnda, Carr. (R.H. 1872:470) is probably a form of M. Azedarach. It is more precocious and very floriferous.—*M. sempervírens*, Sw. From Jamaica. A low-growing tree with leaves deeply incised. Flowers in axillary panicles, small, light lilac, fragrant, in constant succession. A greenhouse species. Probably only a form of *M. Azedarach*. B.R. 8:643.

P. J. Berckmans and L. H. B.

MELIÁNTHUS (*mel*, honey, and *anthos*, flower). *Sapindàceæ*. About 6 species of evergreen shrubs, natives of South Africa. Can be grown out-of-doors in S. Calif. Foliage has a disagreeable odor when bruised: lvs. alternate, stipulate, odd-pinnate; lfts. unequal-sided, toothed: fls. in axillary and terminal racemes, secreting honey plentifully; calyx laterally compressed, with or without a sac-like protuberance at the base, and a nectar-bearing gland within; petals 5, the anterior one abortive; stamens 4, didynamous. *M. Himalayanus* is *M. major*, which has been introduced into S. Asia.

A. *Calyx gibbous at base.*

màjor, Linn. Stem flexnous, glabrous, sometimes 10 ft. or more in height, with a widely creeping root: lvs. gray, a foot or more long, the upper ones smaller; stipules grown together into one large, intra-axillary piece, attached to the lower part of the petiole; lfts. 9–11, 3–4 in. long, 2 in. wide: racemes densely-fld., 1 ft. or more in length: bracts ovate, acuminate: fls. red-brown, 1 in. long: capsule papery, 4-lobed at the apex, 1–1¼ in. long: seeds 2 in each cell, black and shining. Cape. B.R. 1:45. R.H. 1867, p. 131.

AA. *Calyx not conspicuously gibbous at base.*

minor, Linn. Lvs. 5–6 in. long; stipules 2, subulate, lateral, free; lfts. 1½–2 in. long, 6–10 lines wide: racemes 6–12 in. long, subterminal: fls. dull red: capsule obtuse at each end, scarcely 4-lobed, 8 lines long. Cape. Not B.M. 301, which is *M. comosus*.

M. B. Coulston.

MELICÓCCA (Greek, *honey berry;* referring to the taste of the fruit). *Sapindàceæ*. Two or 3 species of tropical fruit trees, natives of Guiana and Trinidad. The Spanish Lime, *M. bijuga*, is cult. in S. Fla. and S. Calif. Its fruits are about the size and shape of plums, green or yellow, and have a pleasant, grape-like flavor. The large seeds are sometimes roasted like chestnuts. The tree grows slowly, attaining 20–60 ft., and bears freely. It can be fruited in the North under glass. Generic characters: lvs. abruptly pinnate: racemes divided: calyx 4-parted; segments imbricated: petals 4; stamens 8; disk complete; stigma peltate, subsessile: ovary 2-celled: berry 1–2-seeded.

bijùga, Linn. Spanish Lime or Ginep. Fig. 1388. Lfts. in 2 pairs, elliptical or elliptic-lanceolate, entire, glabrous: fls. whitish, in terminal racemes. Naturalized in the West Indies. Bears several degrees of frost. The foliage is distinct, the compound lvs. with winged petioles resembling those of *Sapindus saponaria*, the West Indian Soap-berry.

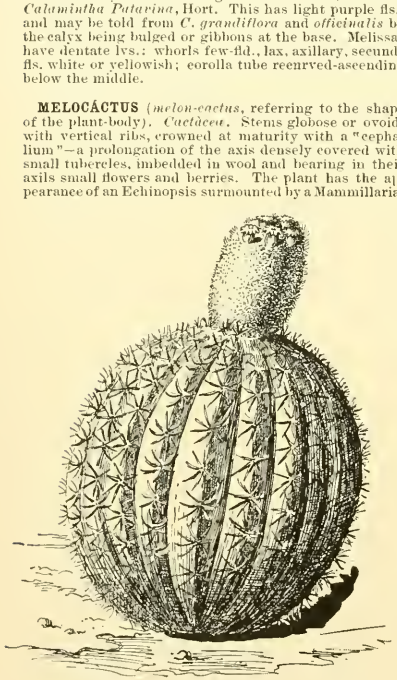
MELILÒTUS (Greek for *honey lotus*). *Leguminòsæ*. Sweet Clover. Perhaps a dozen species of annual or biennial tall-growing, sweet-smelling herbs, widely distributed in temperate and subtropical regions. Lvs. pinnately 3-foliolate, the lfts. toothed and mostly narrow: fls. small, white or yellow, in slender, long-stalked, axillary racemes; calyx teeth short and nearly equal; standard

oblong or oblong-obovate; keel obtuse: fr. a small, few-seeded, not twisted, but more or less reticulated flattish pod. Two species, **M. officinàlis**, Lam. (yellow-fld.), and **M. álba**, Desv. (white-fld.), have become weeds along roadsides and in waste places.

The latter, *M. alba*, is the commoner. It is an erect herb, often higher than a man, flowering abundantly in spring and early summer. It is biennial. It is said to prefer soils rich in lime, and it thrives on poor and dry soils. Under the name of Bokhara clover and sweet clover, it is grown somewhat as a forage plant. Cattle come to like it for grazing, particularly if turned onto it early in the season, before other herbage is attractive. It may also be cut for hay, particularly the second year. About 10 lbs. of seed is required per acre. It is an excellent bee plant. L. H. B.

MELÍSSA (Greek, *bee;* because the bees are fond of Balm). *Labiàtæ*. About 8 species of hardy perennial herbs from Europe and western Asia. *M. officinalis* is Balm (which see), a sweet herb, with white or pale yellow fls. A variegated form is cult. for ornament. It has silvery white markings. *M. Putaviæ*, Benth.= *Calamintha Patarina*, Hort. This has light purple fls., and may be told from *C. grandiflora* and *officinalis* by the calyx being bulged or gibbous at the base. Melissas have dentate lvs.: whorls few-fld., lax, axillary, secund: fls. white or yellowish; corolla tube reenrved-ascending below the middle.

MELOCÁCTUS (*melon-cactus*, referring to the shape of the plant-body). *Cactàceæ*. Stems globose or ovoid, with vertical ribs, crowned at maturity with a "cephalium"—a prolongation of the axis densely covered with small tubercles, imbedded in wool and bearing in their axils small flowers and berries. The plant has the appearance of an Echinopsis surmounted by a Mammillaria.



1389. Melocactus communis (×1-5).

commùnis, Link & Otto. Fig. 1389. Ribs 10–20, acute; areolæ nearly 1 in. apart; radial spines 8–11, straight or curved, subulate; centrals 1–4; cephalium at first low, hemispherical, becoming cylindrical in time, reaching a height of 8 in.; the dense wool of the cephalium is pierced by many red or brown bristles; fls. red, slender; fr. ⅔ in. long, crowned by the persistent remains of the flower, red. West Indian islands. Called there "Turk's Head." B.M. 3090. KATHARINE BRANDEGEE.

MELON. See *Muskmelon* and *Watermelon;* also *Citrullus* and *Cucumis*. **M. Papaw.** See *Carica Papaya*. **M. Shrub.** See *Solanum muricatum*. **Chinese Preserving Melon** is *Benincasa*.

MELÒTHRIA (probably a name for a bryony-like plant; *melon* is Greek for apple, which may refer to the shape of the fruit). *Cucurbitàceæ*. About 54 species of slender herbaceous vines, climbing or trailing, annual or perennial, with small yellow or white fls., found in the warmer parts of the world. Three kinds are known to the trade as *M. scabra*, *Mukia scabrella* and *Pilogyne suavis*, the last being perhaps the best. These three are slender, but rapid-growing, half-hardy, annual climbers, which may be grown indoors in winter, but preferably outdoors in summer for covering unsightly objects. They are presumably more attractive in fruit than in flower.

The latest monographer, Cogniaux in DC. Mon. Phan. Vol. 3, 1881, makes three sections of the genus. *M. scabra* belongs to the first, *M. punctata* to the second and *M. Maderaspatana* to the third. *M. punctata* has sensitive tendrils.

Section I. EUMELOTHRIA. Fls. usually monœcious, males mostly racemose; anthers subsessile: fr. mostly with long and slender peduncles: seeds usually not margined.

Section II. SOLENA. Fls. mostly dicœcious, males corymbose; anthers borne on rather long filaments, the connective not produced: fr. mostly short-peduncled: seeds mostly margined.

Section III. MUKIA. Fls. monœcious, males clustered; anthers subsessile, the connective apiculate: fr. subsessile: seeds margined, usually pitted.

scàbra, Naud. Lvs. rigid, entire or acutely 5-lobed; tendrils unbranched: anthers roundish, with a wide connective, the cells straight, not plicate: fr. ovoid or ovoid-oblong, obtuse, 3-celled, rather large (1 in. long, ½ in. thick), with broad parallel stripes of white and green. Mexico.

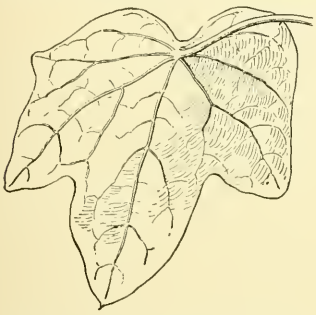
punctàta, Cogn. (*Pilógyne suàvis*, Schrad.). Lvs. membranous, cordate, angled or slightly 3–5-lobed, white-spotted above, pilose, short-hairy or scabrous below, margin remotely denticulate: fr. brown, lightly pitted, about 3 lines thick: seeds small, about 2 lines long, strongly compressed. S. Africa.—Int. 1890 by Henderson & Co. as the Oak-leaved Climber. *Melothria punctata* is a beautiful climbing herbaceous perennial, better known as *Pilogyne suavis*, and sometimes called *Zehneria suavis*. Even when protected, it is too tender to stand the northern winters. It blooms in clusters; fls. small, white and star-shape, with a strong musk fragrance: lvs. green, small and glossy. Being a very rapid grower, it is desirable for covering verandas or for house culture. It will do well in any part of a living room where it has light. It will grow as much as 16 feet high in one summer by having a liberal supply of water every day and liquid manure once a week. After growing outdoors it can be cut down to 6 inches, potted and taken into the house for the winter. In the spring it can be cut back, again planted out and it will do well. The roots can almost be called tuberous, and can be kept dormant during the winter, the same as Dahlias, buried in sand in a cool, dry place, free from frost. Rapidly increased by cuttings.

Maderaspátana, Cogn. (*Mùkia scabrélla*, Arn.). Lvs. scabrous or short-hairy beneath: fr. small, globose: seeds pitted. Trop. Asia and Afr.—"Fruits reddish when ripe." *J. M. Thorburn & Co.* JAMES VICK and W. M.

MENÍSCIUM (Greek, *a crescent;* referring to the shape of the sori). *Polypodiàceæ*. A small genus of about 10 tropical species, with simple or pinnate lvs. and the main veins united by successive transverse arches, on which the naked sori are borne.

reticulàtum, Swz. Stalks 1–3 ft. long, stout: lvs. 2–4 ft. long, 1 ft. or more wide, pinnate; pinnæ 1–4 in. wide, with an acuminate apex, naked or slightly pubescent; main veins 1–1½ lines apart, with 8–12 transverse arches. Mexico and W. Indies to Brazil. L. M. UNDERWOOD.

MENISPÉRMUM (Greek, *moonseed*). *Menispermàceæ*. Moonseed. As conceived by the early botanists, Menispermum contained many species which are now referred to Cocculus, Abuta, Cissampelos, Tinospora, Anamirta and other genera. The genus is now considered to be bitypic, one species occurring in N. America and the other in Siberia, China and Japan. Moonseeds are twining woody vines, with alternate long-petioled lvs., which



1389. Leaf of Menispermum Canadense (×½).

are peltate near the margin, and axillary or super-axillary panicles or cymes of small dioecious fls.: fr. a compressed berry-like drupe, containing a flattened crescent-shaped or curved stone (whence the name Moonseed): stamens 9–24, with 4-loculed anthers in the staminate fls., 6 and sterile in the pistillate fls.; pistils 2–4, with broad stigmas; sepals 4–8, in 2 series; petals 6–8, shorter than the sepals. Both the Moonseeds are neat and interesting vines, and are hardy in the northern states and Ontario. Propagated readily by seeds; or plants of *M. Canadense* may be dug from the wild. Cuttings of ripened wood may also be used.

Canadénse, Linn. Common Moonseed. Fig. 1390. Stems slender and terete, flocculent-pubescent when young, but becoming glabrous, twining 10 ft. or more high: lvs. round-ovate to ovate-cordate, sometimes entire, but usually angulate-lobed, the long petiole attached just inside the margin: fls. greenish white, in loose, straggling panicles, the sepals and petals usually 6, the stamens in the terminal fls. 17–20 and in the lateral ones 11 or 12: fr. bluish black, ¼ in. in diam., resembling small grapes. Rich soils in thickets and lowlands, Quebec to Manitoba and south to Ga. B.M. 1910.

Daùricum, DC. In habit much like the above: lvs. smaller, deeper green, cordate and angular: fls. in cymes, yellowish, the terminal ones with 6 sepals, 9 or 10 petals and about 20 stamens, the lateral ones with 4 sepals, 6 petals and about 12 stamens. Eastern Asia.—Variable. Rarely planted in this country. L. H. B

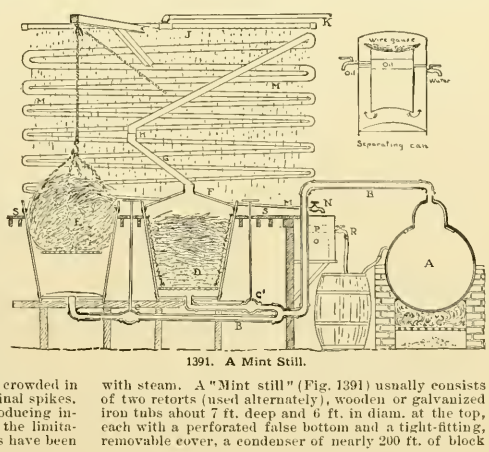
MÉNTHA (from the Greek name of the nymph Minthe). *Labiàtæ*. The term Mint, often applied to various species of the Labiatæ, is most frequently used to designate plants of the genus Mentha. This genus is characterized by its square stems and opposite simple leaves, in common with others of the order, and especially by its aromatic fragrance, its small purple, pink or white flowers, with regular calyx, slightly irregular corolla and four anther-bearing stamens, crowded in axillary whorls and the whorls often in terminal spikes.

Some of the species hybridize freely, producing innumerable intergrading forms which make the limitation of certain species difficult. Many forms have been described, and the synonymy is extensive. About 30 species are now recognized, all native in the north temperate zone, 12 being native or naturalized in North America. Six species are cultivated more or less for the production of aromatic essential oil, which is found in all parts of the herb, and especially in minute globules on the surface of the leaves and calyx.

Peppermint, the most important economic species of Mint, ranks as one of the most important of all plants in the production of essential oils. It was originally native in Great Britain and possibly in continental Europe, but is now widely naturalized, growing in many places on both continents like a native plant. There is no record of it in America previous to its introduction to Connecticut in the early part of the eighteenth century. From there it was taken to western New York and to the Western Reserve in Ohio, and in 1835 "roots" were taken from Ohio to Pigeon Prairie, in Michigan, where the industry has grown to larger proportions than anywhere else. Peppermint is now cultivated commercially in southwestern Michigan and adjacent parts of northern Indiana, Wayne county, New York, and in Mitcham, Surrey and Lincolnshire, England, and in Saxony.

Peppermint plants may be grown on any land that will produce good crops of corn, but its cultivation is most profitable on muck soils of reclaimed swamps. It is an exhaustive crop, and on upland is rarely included in the rotation more often than once in five years. On deep, rich muck soils it is often grown consecutively 6 years or more with no apparent diminution in yield. Peppermint is propagated by pieces of running rootstocks, commonly called "roots." These are planted, as early in spring as the ground can be prepared, in furrows 30 inches apart. On upland two or three crops are usually grown from one setting of the "roots," but in the swamp lands the runners are plowed under after harvest, continuing the crop indefinitely. Clean cultivation is required between the rows, and often it is necessary to hoe the plants or pull weeds by hand, especially on land that has not been well prepared. Fireweed, horseweed, ragweed and other species with bitter or aromatic properties are very injurious to the oil if cut and distilled with the peppermint.

The crop is cut either with scythe or mowing machine in August or early September, when the earliest flowers are developed and before the leaves have fallen. In long, favorable seasons a second crop is sometimes harvested early in November. After cutting, the plants are cured like hay, then raked into windrows and taken to the stills, where the oil is extracted by distillation



1391. A Mint Still.

with steam. A "Mint still" (Fig. 1391) usually consists of two retorts (used alternately), wooden or galvanized iron tubs about 7 ft. deep and 6 ft. in diam. at the top, each with a perforated false bottom and a tight-fitting, removable cover, a condenser of nearly 200 ft. of block

tin pipe immersed in tanks of cold water, or more frequently arranged in perpendicular tiers over which cold water runs, a boiler to furnish steam and a receiver or tin can with compartments in which the oil separates by gravity. The yield of oil varies from 10 to 60 pounds per acre, averaging about 25 pounds for Black Mint, the variety now generally grown. Three kinds of peppermint are recognized: (1) American Mint, "State Mint" of New York (*M. piperita*), long cultivated in this country and occasionally naturalized; (2) Black Mint, or Black Mitcham (*M. piperita*, var. *vulgaris*), a more productive variety introduced from England about 1889, and (3) White Mint, or White Mitcham (*M. piperita*, var. *officinalis*), less productive and too tender for profitable cultivation, but yielding a very superior grade of oil. Peppermint oil is used in confectionery, very extensively in medicines, and for the production of menthol, or more properly pipmenthol. Pipmenthol differs in physical properties from menthol derived from Japanese Mint.

Japanese Mint, *M. arvensis*, var. *piperascens*, is cult. in northern Japan, chiefly on the island of Hondo; not known in the wild state. It has been introduced experimentally in cult. in England and the United States, but has not been cult. commercially in these countries. Its oil is inferior in quality to that of *Mentha piperita*, but it contains a higher percentage of crystallizable menthol, of which it was the original source and for the production of which it is largely used. It is propagated by rootstocks carefully transplanted and cultivated by hand-labor. Two crops, rarely three, are obtained in a season, and by abundant fertilizing and intensive culture large yields are obtained. It is usually continued three years from one planting, and then a rotation of other crops follow for from three to six years. Three horticultural varieties are recognized, being distinguished chiefly by form of leaf and color of stem. The variety known as "Akakuki," with reddish purple stem and broad, obtuse leaves, is regarded as best.

Spearmint is cultivated on peppermint farms for the production of oil. The plants are propagated and cultivated similar to peppermint and distilled in the same stills. The oil, for which there is a smaller demand than for peppermint oil, is used chiefly in medicine and to some extent as a flavoring ingredient in drinks. Spearmint is cultivated in the vicinity of many large cities to supply saloons, where freshly cut sprigs of the plant are used in making the seductive and intoxicating drink known as "Mint julep." The plant is more widely known as an ingredient in "Mint sauce," the familiar accompaniment of spring lamb and green peas. To supply this demand it is often cultivated in the kitchen-garden. It is easily propagated by the perennial root-stocks, and persists year after year with little care, thriving in nearly all kinds of soil, providing it does not become too dry.

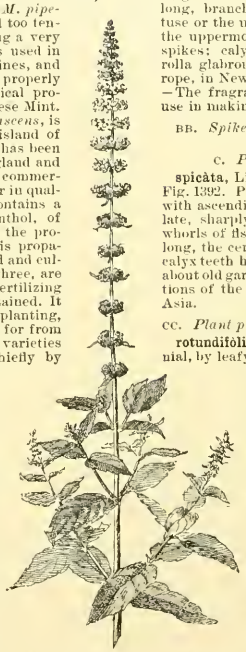
The Pennyroyal of the Old World is *Mentha Pulegium*.

A. *Whorls of fls. in terminal spikes or same in the upper axils.*

B. *Spikes thick: lvs. petioled.*

C. *Lvs. lanceolate, acute.*

piperita, Linn. PEPPERMINT. Perennial, by runners and rootstocks: stems erect or ascending, 1–3 ft. high, branched, glabrous: lvs. lanceolate, acute, sharply serrate, 1–3 in. long, glabrous or pubescent on the veins beneath, punctate, with minute oil globules: fls. in thick, terminal spikes, 1–3 in. long in fruit, the central spike finally exceeded by the lateral ones; calyx glabrous below, its sharp teeth usually ciliate; corolla purple, rarely white, glabrous. Introduced in cultivation from England and occasionally naturalized in moist ground in various parts of the country. Known as "American Mint" or "State Mint," in New York.



1392. Mentha spicata—Spearmint. (×⅓.)

Var. **officinàlis**, Sole. WHITE MINT. Slender, 1–2 ft. high: lvs. 1–2 in. long: stems and foliage light-colored. Not known in wild state; long cult. in Eng. and sparingly introduced into cult. in America.

Var. **vulgàris**, Sole. BLACK MINT. Rather stout, 2–3 ft. high: lvs. 2–3½ in. long: stems usually purple and foliage dark-colored. Native in England. Cult. in recent years in England, Saxony and America.

CC. *Lvs. ovate or subcordate.*

citràta, Ehrh. BERGAMOT MINT. Perennial, by leafy stolons, glabrous throughout: stem decumbent, 1–2 ft. long, branched: lvs. thin, broadly ovate and obtuse or the uppermost lanceolate and acute: fls. in the uppermost axils and in short, dense, terminal spikes: calyx glabrous, with subulate teeth; corolla glabrous. Sparingly naturalized from Europe, in New York, New Jersey, Florida and Ohio. —The fragrant, lemon-scented oil is distilled for use in making perfumes.

BB. *Spikes slender, interrupted: lvs. sessile or nearly so.*

C. *Plant glabrous: lvs. lanceolate.*

spicàta, Linn. (*M. viridis*, Linn.). SPEARMINT. Fig. 1392. Perennial, by leafy stolons: stem erect, with ascending branches 1–2 ft. high: lvs. lanceolate, sharply serrate, 2½ in. or less in length: whorls of fls. in narrow, interrupted spikes 2–4 in. long, the central spike exceeding the lateral ones; calyx teeth hirsute or glabrate. Widely naturalized about old gardens throughout the older settled portions of the United States; native in Europe and Asia.

CC. *Plant pubescent: lvs. elliptic or ovate-oblong.*

rotundifòlia, Huds. ROUND-LEAVED MINT. Perennial, by leafy stolons, pubescent throughout, somewhat viscid: stems slender, erect or ascending, simple or branched, 20–30 in. high: lvs. subcordate at base, mostly obtuse, crenate-serrate, 1–2 in. long and about two-thirds as wide, reticulated beneath: fls. in dense or interrupted spikes 2–4 in. long; calyx pubescent; corolla puberulent. Naturalized in moist waste places from Maine to New Mexico.—Sometimes used as a substitute for peppermint or spearmint.

AA. *Whorls of fls. all axillary.*

B. *Plants usually decumbent: fls. nearly sessile.*

Canadénsis, Linn. AMERICAN WILD MINT. Perennial, by runners and rootstocks: stem usually pubescent, with spreading hairs, erect or ascending, simple or branched, 6–30 in. high: lvs. ovate-oblong or lanceolate, glabrous or nearly so, 2–3 in. long, slender-petioled, the petioles often exceeding the nearly sessile whorls of light purple fls.: calyx pubescent. In wet soil or in water at the margins of streams, New Brunswick to British Columbia and southward to Virginia and New Mexico. It is a common plant.—Often called peppermint, for which it is frequently mistaken and for which it is sometimes used as a substitute. It is variable in habit and also in the character of its oil.

BB. *Plants somewhat rigidly erect: fls. distinctly pedicelled.*

arvénsis, var. **piperáscens**, Malinvaud. JAPANESE MINT. Perennial, by running rootstocks, puberulent or finely pubescent throughout: stems erect, with numerous branches, 2–3 ft. high: lvs. lanceolate and acute to broadly oblong and obtuse, narrowed at the base, 1½–3½ in. long, sharply serrate, with low teeth: fls. in rather loose, axillary whorls, in distinctly pedicellate umbels, usually shorter than the slender petioles; calyx pubescent, its subulate teeth about half as long as the tube; corolla puberulent.

LYSTER H. DEWEY.

MENTZÉLIA (Mentzel, an early German botanist). *Loasàceæ*. About 50 species of erect, sometimes woody herbs, 1–5 ft. high, many natives of North America. Lvs. alternate, mostly coarsely toothed or pinnatifid: fls. solitary or in cymes, white, yellowish, yellow or red; petals 5 or 10, regularly spreading, convolute in the bud, deciduous; stamens indefinite, rarely few, inserted with the petals on the throat of the calyx: seeds flat. They thrive in sunny, moist or dry situations sheltered from strong winds. *M. Lindleyi*, from Calif., is common in eastern gardens, where it is known as *Bartonia aurea;* the other species are offered by western dealers, but are not generally in cult. They flower in summer. Although *M. Lindleyi* has long been a rather common plant in cultivation, it is little known in the wild, being probably a native of central Calif. The seeds should be sown where the plants are to remain, as they do not bear transplanting.

A. *Color of fls. yellow.*

B. *Fls. opening in bright sunshine.*

C. *Petals 1 in. long.*

Lindleyi, Torr. & Gray (*Bartònia aùrea*, Lindl.). Fig. 1393. Annual: stem 1–3 ft. high, branched and straggling: lvs. 2–3 in. long: fls. about 2¼ in. across, bright yellow, very fragrant in the evening, bracted; petals 5, broadly obovate, nearly as broad as long, rounded at the apex except an abrupt short point. Probably central Calif. B.M. 3649. B.R. 22:1831.

CC. *Petals 2–2½ in. long.*

lævicaùlis, Torr. & Gray. Biennial: stem 2–3 ft. high: lvs. 2–8 in. long: fls. yellow, 2½–3 in. across, bractless; petals lanceolate, acuminate. Neb. to Calif. B.B. 2:459.

BB. *Fls. opening towards night.*

nùda, Torr. & Gray. Biennial: stem somewhat slender, 1–5 ft. high: lvs. 1–3 in. long: fls. creamy white, 1½–2¼ in. across, usually bractless; petals 10. Dakota to Kans., Colo. and Tex. B.M. 5483 (as *Bartonia nuda*). B.B. 2:458.

AA. *Color of fls. pure white.*

ornàta, Torr. & Gray. Annual: stem 2 ft. and more: lvs. 2–6 in. long: fls. 5 in. across, opening towards night, fragrant, usually bracted; petals 10; stamens 200–300. Dakota and Mont. to Tex. R.H. 1878:430. B.M. 1487 (as *Bartonia decapetala*). B.B. 2:459.

M. B. COULSTON and W. M.

MENYÁNTHES (Greek, *men*, a month, and *anthos*, flower; perhaps because it flowers for about a month). *Gentianàceæ*. BUCKBEAN. A genus of 2 species of small perennial bog plants with creeping rootstocks and small, 5-lobed white or purplish fls. borne in late spring. They are procurable from dealers in native plants. The genus is one of the few aquatic groups in the gentian family. It is allied to Limnanthemum, but the fls. of the latter are not bearded or crested on the face as they are in Menyanthes. Lvs. all alternate, stalked: corolla somewhat funnel- or bell-shaped; stamens inserted on the tube of the corolla; hypogynous glands 5: style long.

trifoliàta, Linn. BUCKBEAN. About 9–18 in. high: lfts. 3, oval or oblong-obovate, 1–1½ in. long: raceme about 12-fld. Bogs, north temperate regions. B.B. 2:622. V. 2:198 and 3:208.—The lvs. are said to be used in Germany as a substitute for hops in beer-making. A very interesting bog plant.

MERCURY. *Chenopodium Bonus-Henricus.*

MERENDÈRA (from *quita meriendas*, Spanish name of *Colchicum autumnale:* some of these plants formerly considered to belong to Colchicum). *Liliàceæ*. About 10 species of bulbous plants, mostly natives of the Mediterranean region and Asia Minor. They belong to the same tribe with Colchicum and Bulbocodium, but Colchicum has a real corolla tube, while the other two genera have 6 very long-clawed segments which are merely connivent, forming a loose tube at first and afterwards separating. In Merendera there are 3 styles which are distinct from the base, while in Bulbocodium the style is 3-cut only at the apex. Merenderas are low, stemless plants with tunicated corms: lvs. linear, appearing with the fls.: fls. 1–3, appearing in spring or fall, mostly lilac-colored. The genus is divided by Baker (Jour. Linn. Soc. 17:438, 1880) into two groups, based on the anthers. The 2 species described below belong to the group with small, oblong, versatile anthers, which are fastened at the middle rather than the base. They are hardy spring-blooming plants with about 3 lvs., and fls. 1–1½ in. across. These rare plants are procurable from Dutch bulb-growers. They are pretty, small-fld., early-blooming, hardy, fragile plants which persist well under good garden cultivation.

1393. Mentzelia Lindleyi (×½).

A. *Blade of petals oblanceolate, obtuse.*

Caucásica, Bieb. The 3 outer corolla segments appendaged on each side at the junction of blade and claw; new corms sessile. Caucasus, Persia. B.M. 3690.

AA. *Blade of petals lanceolate, acute.*

sobolífera, Fisch. & Mey. Segments not appendaged: a very small new corm produced at the apex of a shoot. Asia Minor, Persia.

M. Ruthénica is advertised by Van Tubergen.

J. N. GERARD and W. M.

MERTÉNSIA (after Mertens, a German botanist). *Borraginàceæ*. About 15 species of perennial herbs, natives of the north temperate zone, the most popular of which is *M. pulmonarioides*, better known as *M. Virginica*, Virginia Cowslip, Blue Bells, and Virginia Lungwort. This grows 1–2 ft. high and bears more or less drooping clusters of blue-belled fls. in March to May (see Fig. 1394). The fls. are about 1 in. long, and 20 or more in a terminal group. They have a purple tube and blue bell of distinct shape, the lobes of the corolla being less pronounced than in the other species. Mertensias are allied to Pulmonaria, but the fls. have no bracts, as in Pulmonaria. They are botanically nearer Myosotis, which contains the forget-me-nots. Mertensias are glabrous or pilose: lvs. alternate, often having pellucid dots: racemes terminal or the cymes loose, few-fld., 1-sided, sometimes panicled: fls. blue or purplish, rarely white; calyx 5-cut or 5-parted; lobes 5; stamens fastened at the middle of the tube or higher.

The common Mertensia is one of the plants that should remain undisturbed for years, and hence is suited to the rockery. Its leaves die down soon after flowering time. The plant should have a sheltered position, full sunshine and rich, loamy soil. *M. Sibirica* is considered by some even more desirable. The fls. are later, light blue, and not as distinctive in form. The foliage of *M. Sibirica* lasts through the summer. Mertensias may be prop. by seed if sown as soon as ripe, but with uncertainty by division. Although of secondary importance, Mertensias add variety to the border and are nearly always attractive to plant-lovers.

1394. Virginian Cowslip or Blue Bells —Mertensia pulmonarioides (×⅛).

A. *Fls. trumpet-shaped, the open portion not prominently 5-lobed; filaments much longer than the anthers.*

pulmonarioides, Roth. (*M. Virginica,* DC.). VIRGINIAN COWSLIP. BLUE BELLS. Fig. 1394. Very smooth and glabrous; lvs. obovate or oblong, or the lowest large, rounded and long-stalked; veins conspicuous: fls. generally more nodding than shown in Fig. 1395. Spring. N. Y. to S. C. and Tenn., usually inhabiting low or moist grounds. B.M. 160 (as Pulmonaria). B.B. 3:60. Gn. 23, p. 463, and 32, p. 173. V. 3:181; 7:244; 11:180, and 12:140. Mn 4:33.

AA. *Fls. with the upper portion more bell-shaped and prominent spreading lobes: filaments shorter than the anthers or only a little longer.*

B. *Tube of corolla 2 or 3 times as long as the bell.*

oblongifòlia, G. Don. About 9 in. high, smooth: lvs. mostly oblong or spatulate-lanceolate; veins inconspicuous: calyx lobes acute. Western N. Amer.—Not easy to cultivate.

BB. *Tube of corolla not twice as long as the bell.*

C. *Calyx-lobes obtuse, oblong.*

Sibírica, G. Don. This and the next grow 1–5 ft. high and have broad, veiny lvs., the upper ones very acute or acuminate. *M. Sibirica* is pale, smooth and somewhat glaucous: stem-lvs. oblong- or lanceolate-ovate. E. Siberia, Rockies and Sierras. Gn. 18:259.—Offered by some American dealers.

CC. *Calyx-lobes acute, lanceolate or linear.*

paniculàta, G. Don. Greener than *M. Sibirica,* roughish and more or less pubescent: stem-lvs. ovate to oblong-lanceolate. Lake Superior and north, E. Asia. B.B. 3:60. B.M. 2680 and B.R. 2:146 (as *Pulmonaria paniculata*).

M. umbrátilis, Greenm., from Oregon, a recently described species, is offered by Horsford. Allied to *M. Sibirica,* but has larger corolla and longer lanceolate-acute calyx-lobes.

G. C. WOOLSON and W. M.

MESCAL BUTTON is *Echinocactus Williamsii.*

MESEMBRYÁNTHEMUM (Greek, *midday flower;* the flowers usually open in sunshine and close in shadow). *Ficóidex,* or *Mesembryáceæ.* FIG MARIGOLD. The type genus of a family of something more than 20 genera and about 500 species, widely distributed in dry tropical and subtropical regions. Of the other genera known to horticulturists, only Tetragonia and Sesuvium are prominent, and even these are relatively unimportant. Mesembryanthemum itself includes some 300 species, nearly all of which are South African, according to Sonder "abounding throughout the arid plains and sands of the whole country to the south of the Orange river and west of the Great Fish river." Four species are described by Bentham in Flora Australiensis. Two (*M. crystallinum* and *æquilaterale*) are native in California. Others occur in New Zealand, Canaries, Arabia and the Mediterranean region. They are succulent plants, mostly herbs, but some are shrubs. They are allied botanically to the cactaceous series, although lacking the spines of those plants and bearing true leaves. Horticulturally, they are fanciers' plants, and are classed with "succulents." Very few are in the general trade, although a number are advertised in California and others are in botanic gardens. Usually the flowers open only in bright sunlight, but there are a few evening-blooming species. As with most succulents, the species are not well understood botanically, owing largely to the difficulty in making herbarium specimens. Many of them are of odd and grotesque form. One species, *M. crystallinum,* is a common house plant, being known as Ice Plant, but it is one of the least showy in flower. It is grown for the thick glistening foliage. It propagates readily by seed or division. The best available account of the Mesembryanthemums is Sonder's elaboration of the S. African can species (293 numbers) in Flora Capensis, Vol. II (1861–2)

L. H. B.

In Mesembryanthemum the leaves are mostly opposite, entire or the margin somewhat spiny, fleshy and often subcylindrical or triangular in cross-outline; flowers perfect and regular, axillary and solitary or somewhat corymbose; calyx gamosepalous, usually with 5 unequal lobes and the tube adnate to the ovary; petals very many, in one or more rows, usually linear, white, yellow or rose-color; stamens very numerous; ovary most commonly 5-loculed; fruit or capsule opening radially at the summit, hygroscopic; seeds very numerous, small. "The capsules are tightly closed in dry weather and open naturally after a rain," writes Sonder. "If thrown in water until it becomes thoroughly soaked and then removed, an old capsule will open out its capillary valves, radiating from a center like a star; and will close them again when dry. This experiment may be repeated several times without destroying their remarkable hygrometric property." The following species are S. African unless otherwise noted. Mostly perennials.

Mesembryanthemum, or Fig Marigold, is a large genus, and the majority of the species are natives of the Cape of Good Hope. They are found in their native habitats growing most luxuriantly on dry, barren, rocky places and on dry, sandy plains. They are succulent plants with thick, fleshy leaves, and are therefore able to stand the severe drought they have to put up with in those arid places. Knowing that these plants delight in dry, arid situations, this gives the key to their cultivation. When grown in pots, care should be taken that the pots are well drained. A light, sandy loam, mixed with brick rubbish broken small, makes a good compost for them. In summer they can be placed out-of-doors in a slightly elevated and sunny position, where they will produce an abundance of their showy blossoms. On the approach of cold weather in the fall they may be placed in a cool greenhouse with a dry atmosphere and plenty of air. Very little water is needed during the dull months of winter. Some of the species make good window plants. *M. cordifolium,* var. *variegatum* is largely grown for edgings for beds. *M. pomeridianum* and *M. tricolorum* are good showy annuals. Propagation is effected either by cuttings or by seeds. Cuttings should be dried in the sun for two or three days before they are inserted in sand.

ROBERT CAMERON.

INDEX.

A. Epapulosa: *Plant not bearing glittering papillæ or projections* (species 1–23).

B. *Plant stemless or nearly so.*

C. *Lvs. 4–6, semi-terete at the base, thickening and triquetrous at the apex.*

1. **tigrinum,** Haw. Tiger's Jaw. Stemless or essentially so: lvs. cordate-ovate, 2 in. or less long, glaucous green and marbled with white, the upturning edges with long, soft, ciliated teeth, the keel entire: fls. nearly sessile, large, yellow. B.R. 3:260.

2. **felinum,** Haw. Fig. 1395. Lvs. triquetrous, rhomboid-lanceolate, 2 in. or less long, but narrower than in the last, somewhat glaucous, faintly dotted with white, the edges with 8 ciliate teeth; keel entire: fls. nearly sessile, yellow.

CC. *Lvs. 4–6, triquetrous, thickened from the base to the middle, but tapering to the apex.*

3. **albinàtum,** Haw. Stemless: lvs. curved-triquetrous upwards, with a recurved mucro or spine at the apex, bearing elevated whitish dots: fls. sessile, yellow.

CCC. *Lvs. half-cylindrical, of various sizes or forms on the same plant, in alternate pairs.*

4. **angùstum,** Haw. Nearly or quite stemless, small: lvs. 2-ranked, linear, tongue-shaped, long, keeled at the apex, somewhat unequal, one of them straight-acute and the other hooked: fls. nearly sessile, yellow.

CCCC. *Lvs. tongue-shaped, with one margin thicker than the other, of two or more forms, 2-ranked.*

D. *Peduncle less than 1 in. long.*

5. **linguæfòrme,** Haw. Lvs. unequally tongue-shaped, deflexed and somewhat falcate, becoming depressed when old, flattish above, obliquely attenuate: fls. yellow. Index Kewensis makes the *M. linguæforme* of Haworth synonymous with *M. obliquum*, Willd., and uses Linnæus' *M. linguiforme* as a tenable name.

DD. *Peduncle 1 in. or more long.*

6. **cultràtum,** Salm-Dyck. Lvs. 2-ranked, thick, tongue-shaped and curved like a pruning-knife, blunt at the apex: fls. yellow, on a somewhat 3-angled peduncle.

7. **deprèssum,** Haw. Prostrate: lvs. narrow, tongue-shaped, recurved-depressed, acute: fls. yellow, with petals somewhat recurved.

8. **pustulàtum,** Haw. Lvs. 2-ranked, narrow, tongue-shaped, long and ascending, blunt, bearing pustules near the base: fls. yellow.

BB. *Plant with an evident erect or prostrate stem.*

C. *Foliage lvs. distinct or essentially so (not truly perfoliate nor connate).*

D. *Stem or caudex prostrate.*

E. *Peduncle with 2 bracts.*

9. **tricolòrum,** Haw. (*M. tricolor*, Hort.). Stem 1 ft. long: lvs. cylindrical, acute, green, 2–3 in. long, minutely punctate: fls. yellow, blood-colored inside, the petals acute, the anthers brown. Gn. 24, p. 89.—There is a white-fld. form.

10. **acinacifòrme,** Linn. Stem articulate, 2–3 ft. long, the young growth compressed: lvs. opposite, 2–3 in. long, simitar-shaped (curved and thicker on one edge), the keel dilated: fls. purple, about 4 in. across, "the largest in the genus," the stigmas 14: fr. size of a gooseberry, and eaten by Hottentots.—Handsome.

11. **rubrocinctum,** Haw., is probably a form of the last, differing in having a red line on the keels of the lvs. B.R. 20:1732.

12. **æquilateràle,** Haw. Differs from *M. acinaciforme* chiefly in thinner lvs. and smaller fls.: fls.. fragrant, 1½ in. across. Native to Australia, Tasmania, Chile and S. Calif.

EE. *Peduncle without bracts.*

13. **édule,** Linn. Stem angular: lvs. opposite, 3–4 in. long, triquetrous, curved, the keel serrate: fls. large, yellow or purple, the stamens 8: fr. edible, being one of the Hottentot Figs. Grows well on the sea cliffs in S. England, making long, hanging masses (Gn. 55, p. 235, with picture).

DD. *Stem, or at least the branches, erect or prominently ascending.*

E. *Fls. yellow, orange or copper-color.*

14. **aurantiacum,** Haw. Stem becoming 1 ft. or more high, much branched, sometimes decumbent at base, the branches somewhat compressed: lvs. 1 in. or less long, smooth and glaucous, bluntly triquetrous: fls. orange, with petals ¾ in. long and in about 3 series.

15. **aùreum,** Linn. Larger: lvs. 1½–2 in. long, cylindrically triquetrous, smooth and glaucous, mucronate: fls. golden, 2 in. across, the petals in many series. B.M. 262.—In this and the last, the lower lvs. are often nearly connate at the base.

EE. *Fls. rose-color or purplish.*

F. *Petals of two unlike kinds,—subulate and linear-lanceolate.*

16. **mutàbile,** Haw. With straw-color or reddish tortuous, erect branches: lvs. about ½ in. long, compressed-triquetrous, incurved, the keel entire, apex acute: fls. mostly solitary on an upwardly thickened peduncle, rose-color, the inner short petals pale yellow.

1395. Mesembryanthemum felinum (×⅓).

17. **inclaùdens,** Haw. Distinguished from the last by scimitar-shaped lvs. and broader petals: lvs. crowded, green, compressed-triquetrous and scimitar-shaped (thicker on one edge).

FF. *Petals of one kind.*

18. **blándum,** Haw. Two ft., with numerous branches: lvs. distant, 2 in. or less long, compressed-triquetrous, but with equal sides, narrow, minutely dotted, acutish: fls. 2 in. across, pale rose, the petals toothed. B.R. 7:582. L.B.C. 6:599.

19. **spectábile,** Haw. Stem prostrate, but branches ascending: lvs. 2–3 in. long, crowded, glaucous, incurved and spreading, triquetrous, attenuate and mucronate: fls. purplish; petals 1 in. long, the inner somewhat shorter. B.M. 396.

20. **muricàtum,** Haw. Stem suberect: plant bluish: lvs. less than ½ in. long, somewhat incurved, deltoid and toothed, very glaucous: fls. small and fragrant, the petals acute.

CC. *Foliage lvs. truly connate or perfoliate.*

D. *Lvs. triquetrous.*

21. **geminàtum,** Haw. Dwarf: stem subshrubby, the branches procumbent: lvs. erect, glaucous white, the cartilaginous margins entire: fls. white (?).

22. **acutángulum,** Haw. Stem shrubby, with rigid and erect branches: lvs. sheathing, ½ in. long and about as long as the internodes, glaucous green, triquetrous, compressed near the apex, somewhat incurved: fls. white, small, in a panicle.

DD. *Lvs. elongated, subulate or somewhat cylindrical.*

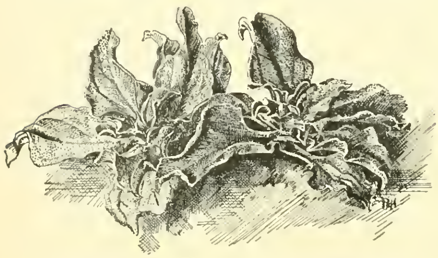
23. **stipulàceum,** Linn. Dwarf, with erect, decussate branches: lvs. 1½–2 in. long, very slender, crowded, spreading and recurved, very glaucous: fls. in the axils, mostly solitary, purplish.

AA. PAPULOSA: *Plant usually bearing glittering papillæ, vesicles or projections on stems and lvs.,—hence the popular name Ice Plant* (species 24–33).

B. *Root annual or biennial (cult. as annuals).*

C. *Fls. white or rose-color, sessile or nearly so.*

24. **crystallinum**, Linn. ICE PLANT. Fig. 1396. A common plant in window-gardens and hanging baskets, and readily grown from seeds (which are offered by seedsmen), procumbent: lvs. flat, fleshy, ovate or long-spatulate, usually clasping, undulate, covered with glistening dots or elevations: fls. small, whitish or varying to light rose-color. S. Afr., Greece, Canary Islands, S. Calif.—Grown for its glistening foliage. Fls. open in the sun.



1396. Common Ice-plant—Mesembryanthemum crystallinum. (×¼.)

CC. *Fls. yellow, long-peduncled.*

25. **pomeridiànum**, Linn. Stem simple or forking, the branches ascending, hairy on branches, peduncles and calices: lvs. lance-spatulate or spatulate, narrowed into a petiole, ciliate: 2 of the calyx lobes longer than the petals; petals linear-lanceolate.

26. **glàbrum**, Ait. Glabrous: lvs. lance-spatulate, petiolate and dilated at base: fls. straw-colored, darker at the eye; lobes of the calyx linear and unequal.

BB. *Root perennial and the stem becoming somewhat woody.*

C. *Lvs. flat, petiolate.*

27. **cordifòlium**, Linn. Stems 1–2 ft., diffuse, minutely papillose: lvs. opposite, 1 in. or less long and nearly as wide, cordate-ovate, somewhat papillose: fls. solitary, peduncled, purple, the petals short and linear. A var. **variegàtum** is in cult., and is a good half-hardy trailing plant.

CC. *Lvs. compressed-triquetrous, not petiolate.*

28. **élegans**, Jacq. Shrubby, 6–12 in. or more tall, branchy, whitish or red: lvs. crowded, ½ in. long and very narrow, very glaucous, scabrous: fls. numerous, mostly panicled, pale red (or whitish), the petals ½ in. long.

CCC. *Lvs. terete or nearly so.*

D. *Branches hispid or bristly.*

29. **subcompréssum**, Haw. Erect, 2 ft.: lvs. not crowded, ¾ in. or less long, narrow, very blunt, greenish canescent, flattened-terete: fls. solitary, purplish; calyx lobes unequal.

30. **floribúndum**, Haw. Tortuous in growth, the branches not over 6 in. long, more or less decumbent: lvs. less than 1 in. long, very narrow, terete, curved, obtuse, a little thicker towards the apex: fls. small, axillary, rose-color, the 5 styles exserted, the petals twice longer than the calyx.

DD. *Branches not hispid.*

31. **barbàtum**, Linn. A foot or more tall, diffuse and decumbent: lvs. not crowded, ½ in. long, spreading, green and pellucid, semi-cylindrical, with 5 or 6 hairs at the end: fls. solitary, reddish, the petals entire and 2–3 times longer than the calyx.

32. **stellàtum**, Mill. Three or 4 in. high, fleshy and tufted: lvs. crowded, ⅓ in. long, glaucous, semi-cylindrical, scabrous, with many hairs at the apex: peduncles hairy: fls. reddish violet, the calyx campanulate, ¼ in. long.

33. **dénsum**, Haw. Much like the last: lvs. longer, flattish above and convex beneath, ciliate also at the base: calyx longer: fls. reddish violet. R.H. 1869, p. 356.

Accessible pictures of Mesembryanthemums which are not mentioned in American lists, are as follows: *M. Bolùsii*, Hook. f. B. M. 6664.—*M. Brównii*, Hook. f. B. M. 6985.—*M. criniflòrum*, Linn. R. H. 1857, p. 122 (as M. cuneifolium).—*M. ficifórme*, Haw. G. C. II. 25:373.—*M. minutum*, Haw. R. H. 1869, p. 356.—*M. pugionifórme*, Linn. R. H. 1857, p. 178.—*M. ròseum*, Willd. Gn. 52, p. 439.—*M. testiculàtum*, Jacq. R. H. 1869, p. 35 (as M. octophyllum).

L. H. B.

MESOSPINÍDIUM (Greek compound; meaning obscure). *Orchidàceæ*. The plants cultivated as Mesospinidium are referred by some to the genus Cochlioda. They have the habit of a slender Odontoglossum, with sheathing lvs. at the base of the pseudobulbs. Fls. in racemes or panicles; sepals and petals sub-similar, expanded; labellum with 2 longitudinal ridges, adnate to the column, with rounded lateral lobes and a narrow middle lobe: column long or short: pollinia 2, seated on a rhomboid pedicel. These plants are evergreen coolhouse orchids, and thrive well in baskets of peat and moss, with plenty of water. Cochlioda has about 5 species, of which the following is often cultivated:

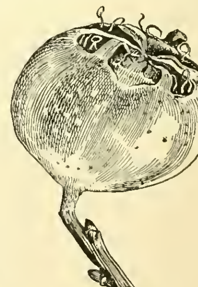
sanguíneum, Reichb. f. Pseudobulbs oval, 2-lvd., mottled: lvs. ligulate, sharp-pointed, shorter than the many-fld. drooping panicle: fls. numerous, small, vivid rose; the lower sepals are partially united, oblong; petals cuneate-ovate. Peruvian Andes. B.M. 5627.

M. vulcánicum, Reichb. f., is described as Cochlioda vulcanica (p. 341), its proper name.

HEINRICH HASSELBRING.

MÉSPILUS (Greek, substantive name). *Rosàceæ*. MESPIL. MEDLAR. From Pyrus, with which this genus is united by British authors, Mespilus differs in bearing the flowers singly on leafy growths of the season (the fruits, like the quince, having no true detachable peduncles as pears and apples do), and in having the top of the ovaries not covered by the over-growing receptacle. There is but one species of true Mespilus, but some authors (e. g., Focke, in Engler & Prantl's "Die Natürlichen Pflanzenfamilien") include some of the Cratægus species in the genus.

The common Medlar is **Méspilus Germánica**, Linn., native to Central Europe. To a considerable extent in parts of Europe it is grown for its acid fruits, but in this country it is very little known. It is perfectly hardy in central New York, and its cultivation requires no special treatment or skill. It makes a twiggy, tough-wooded bush or small tree, 10 to 15 feet high, bearing large white blossoms late in May or early in June, after the leaves are full size. The foliage is soft and luxuriant; leaves lance-oblong or long-oblong, pubescent, simple, serrate. The fruit (Fig. 1397) remains hard and austere until mellowed by frosts. With the freezing and the incipient decay, the fruit becomes brown and soft. It is usually picked after it is touched by frost and laid away on shelves or in drawers in a cool, dry room; the ripening process which follows is known as bletting. When finally softened, it is agreeable for eating from the hand, particularly for those who enjoy fruit-acids. It also makes good preserves.



1397. Medlar—Mespilus Germanica. Natural size.

Medlars are easily raised from seeds, although seeds (like those of Cratægus) may not germinate the first year. On these stocks the named varieties may be grafted or budded. Medlars may also be worked on pear, thorn (Cratægus) or quince. The Dutch or Hollandish and the Nottingham are the leading varieties. The fruit of the former is often 2½ inches in diameter. The latter is much smaller, but is better in quality. There is also a seedless variety.

M. grandiflòra, Smith (M. Smithii, DC.), is Cratægus grandiflora (see p. 397). Gn. 22, p. 163 and 34, p. 66. L. H. B.

MESQUIT of Mexico is *Prosopis juliflora* (Leguminosæ). A picture of a Mesquit forest is shown in G. F. 1:116.

METROSIDÈROS (Greek, *heart of iron*; this and other genera of the Myrtle family are called ironwoods). *Myrtàceæ*. About 18 species of trees and shrubs, rarely climbers, mostly natives of the Pacific islands from New Zealand to Hawaii. They belong to the class of Australasian shrubs whose chief beauty lies in their long red anthers. They are somewhat grown for a fancy Easter trade by florists, largely from imported stock. In Metrosideros the flowers are borne in dense 2- or 3-forked cymes, while in Callistemon they are borne in spikes. Leaves mostly opposite: petals 5, spreading; stamens 1 inch or more long, much longer than the petals. The species described below are coolhouse shrubs, and are rarely grown outdoors in the South.

Apparently the commonest of the Bottle Brushes in the trade is *Callistemon lanceolatus*, which is passing among florists as *Metrosideros floribunda* and *M. robusta*. In Fig. 320 (page 218) the plant is shown with apparently terminal inflorescence, but the branch is really terminated by some leaf buds, which develop later, as in Fig. 1398. The handsome plant figured in William Scott's "Florists' Manual," and to which he refers in the following paragraph as *Metrosideros robusta*, seems to be none other than *Callistemon lanceolatus* (see supplementary list). W. M.

The plant known to the trade as *Metrosideros robusta* has been grown for many years as a cool greenhouse plant, but it is only within a dozen years that Europeans have been sending American florists the compact little bushes that now arrive with our Azaleas. The city florist can perhaps dispose of one of these Bottle Brushes for every ten plants of *Azalea Indica*. Plants in 6-inch pots, well flowered, fixed with a red ribbon and placed in a modern basket certainly look novel and attractive. The Belgians grow the young plants in peat, as they do most hardwooded plants, but they do very well in good turfy loam with a fourth of leaf-mold. Cuttings of the young growth may be struck in early spring and planted out in good soil by the end of May, but it is cheaper to import stock. When the plants arrive soak the ball of roots, pot firmly and place them in a house of about 45°. Freshly imported plants cannot be forced in much heat, like Azaleas, or they will shed their flowers. Watch them carefully, give them more heat gradually and they will bloom for Easter.

Plants unsold the first spring will be much more satisfactory the second year. By the end of April cut them back to within 1 or 2 inches of the old growth, put them in a good heat and keep them syringed. They will make a bushy growth, with a good number of shoots. Early in June plunge them in a sunny spot outdoors, with the rim of the pot well covered, and be careful that they do not suffer for water in hot weather. In July, or earlier, mulch the pots with an inch of half-decomposed cow manure. Before frost remove the plants to a temp. of 45°, or warmer if bloom is desired before Easter.

WILLIAM SCOTT.

A. *Flowers red.*

robùsta, A. Cunn. Lvs. opposite, elliptic-ovate, obtuse, veiny, with an extra nerve near each margin and parallel, glabrous: inflorescence a 3-forked cyme: fls. red; calyx top-shaped. New Zeal. B. M. 4471 (erroneously as *M. florida*).

AA. *Flowers yellowish.*

flòrida, Sm. Lvs. opposite, obovate-oblong, veiny, glabrous: inflorescence a thyrse: fls. yellowish; calyx top-shaped, minutely silky. New Zeal. Not B.M. 4471, which is *M. robusta*.—The typical form is not advertised, but only var. **variegàta**.

M. floribùnda is not advertised in America, but stock imported by an Ithaca florist under this name from Belgium is Callistemon lanceolatus (Fig. 1398). M. floribunda, Smith, is

1398. Metrosideros floribunda of the trade, but Callistemon lanceolatus of the botanists.

thought to have white fls. Lvs. opposite, petiolate, ovate-lanceolate: fls. in an umbel-like, decussately branched panicle. Australia.—*M. semperflorens*, Lodd.=Callistemon lanceolatus. —*M. speciòsa*, Sims=Callistemon speciosus. W.M.

MEXICAN TEA. Consult *Chenopodium*.

MEYÈNIA. See *Thunbergia*.

MEZEREUM. See *Daphne Mezereum*.

MICHAÙXIA (André Michaux, 1746–1802, French botanist, who lived for ten years in America and wrote much on American plants). *Campanulàceæ*. About 4 species of rather coarse-habited biennial herbs from the Orient, of which *M. campanuloides* is best known. It grows 4–5 ft. high, has irregularly toothed, bristly-hairy foliage and large, curious drooping fls., white, tinged with purple, wheel-shaped at first, later reflexed. The flower is parted nearly to the base into 8–10 oblong segments, 1½–2 in. long. This plant is a striking subject for the back of a hardy border. It is easily prop. by seeds (which should be fresh), and likes a well-enriched soil of a light nature. An American dealer offers a climber with bell-shaped fls. under the name of *M. campanulata* but these plants are erect herbs.

Michauxia belongs, with Campanula and other genera of garden importance, to a group characterized by having the capsule closed at the top and opening laterally by little holes between the ribs or by small solitary valves. Michauxia is distinguished from the other genera of this group by the 8–10-parted corolla with narrow, spreading, finally reflexed lobes and an 8–10-celled ovary. Michauxias are erect plants, hispid or glabrous: lvs. irregularly toothed or lobed, the stem-lvs. few: fls. terminal or strung along the branches, the top ones opening first, peduncled or nearly sessile, white or pale rose.

campanuloìdes, L'Hér. Lvs. lanceolate in outline; upper ones sessile, acute, almost clasping: calyx with reflexed appendages shorter than the lobes; stamens 8. Asia Minor. B.M. 219. J. B. KELLER and W. M.

MICHÈLIA (P. A. Micheli, 1679–1737, Italian botanist). *Magnoliàceæ.* Twelve to 17 species of temperate and tropical trees, mostly natives of mts. of India, 2 of which are cult. in our southern states for their handsome magnolia-like foliage and red or pale yellow, fragraut fls. Fls. mostly axillary, solitary; sepals and petals similar, 9–15 or more, in 3 or more series; stamens as in Magnolia; carpels in a loose spike; stigma decurvent: ovules 2 or more: fr. a long, loose or crowded spike of leathery carpels, which split down the back: seeds like Magnolia.

A. *Fls. pale yellow.*

Champàca, Linn. A tall tree native of the Himalayas: lvs. ovate-lanceolate, tapering to a long point, 8–10 in. long, 2½–4 in. broad, shining above, pale and glabrous or puberulous beneath; petiole 1½ in. long: fls. 2 in. across; sepals oblong, acute; petals linear: fr. 3–4 in. long.

AA. *Flowers red.*

fuscàta, Blume. Lvs. elliptic-lanceolate: none of the sepals or petals linear. China. B.M. 1008 (*Magnolia fuscata*). M. B. Coulston.

Michelia fuscata is one of the most popular garden shrubs in the southern states. It is known as the Brown-flowered or Banana shrub; also *Magnolia fuscata.* It is shrubby in habit, attains a height of 10 to 15 ft. and is perfectly hardy in the middle and lower South. The shining young twigs and petioles are covered with brown tomentum. The fls. are 1–1½ in. across, brownish yellow, edged with light carmine, exhaling a strong banana fragrance. The flowering period extends from the end of April until June. Prop. by seeds as stated for *Magnolia grandiflora,* but as seed is somewhat scarce, the better method is from ripened wood cuttings, under glass and with bottom heat. The cuttings should have 1 or 2 lvs. left, and be cut before very cold weather. It is a very desirable conservatory shrub in northern sections.

P. J. Berckmans.

MICHIGAN HORTICULTURE. Fig. 1399. The location of the lower peninsula of Michigan is a most fortunate one for the pursuit of horticulture. Flanked on either side by a great body of water, the climate is modified materially both summer and winter, thus affecting the kind and quality of products that can be successfully grown. Peaches are regularly ripened on a parallel that forms the northern boundary of Vermont; even figs have been ripened in the open air in the southwestern corner of the state. This modification of climate affects not only temperature, but humidity; and on the side of prevailing winds during the heated season there is greater immunity from drought as a result of the moisture-laden atmosphere.

Michigan is covered with drift, and the soil in the western portion is, in considerable measure, open and porous in character, but having as a constituent properties admirably suited to the growth of trees. The kind of timber growing naturally upon the soil of western Michigan has deceived many people with regard to the character of the soil. Elsewhere heavy timber has usually grown on clay loam, but some of our light, sandy soils were covered originally by a heavy growth of beech, maple and basswood. This peculiar adaptation of western Michigan to the growth of timber trees has been a strong factor in favor of orcharding, and some of the finest orchards are upon the lighter lands.

There was a wide range of wild fruits indigenous to Michigan, and the early seeds of apples and pears brought by the French missionaries produced trees of wonderful vigor and fruitfulness. Many of these trees are still standing in the vicinity of the old missionary stations. For a good many years after the early settlements in the state, fruit and garden products were raised simply as an accompaniment of the farm home or the town garden. Market horticulture has followed the rapid growth of cities and the development of modern methods of transportation.

The apple-growing region covers the southern part, extending northward and covering what is known as the "Thumb" (south of Saginaw bay), reaching as far north on the Huron shore as the Straits of Mackinac, and on the western, with a somewhat wider belt, to and including the Grand Traverse region. This same area is well adapted to the growth of the pear, cherry, and most of the small fruits. Peach-growing for profit is followed in a rather narrow belt along the west shore of Michigan, technically denominated the "peach belt," and upon reliefs of ground over a much wider area, extending even twenty to forty miles toward the interior from Lake Michigan; the northern terminus of this belt is Grand Traverse bay. At the date of this writing (1900) the most promising apple region lies in the middle-western part of the lower peninsula. The aggregate acreage devoted to apple-growing in the 39 apple counties is 202,587; and the acreage of peaches in the 12 counties in which this fruit is grown commercially is 39,051.

In the evolution of commercial horticulture in Michigan, specialties have been developed and we find the peach a leading product wherever it can be successfully grown. To illustrate the rapid increase of peach growing in the state, it is enough to say that the average number of trees planted in the state annually, between 1890 and 1900, was 750,000. The shipments from the western part of the state are uniformly large, and the aggregates are often, in productive years, enormous. The color of the fruit is not as high as we find it in southern latitudes, but the quality is superior. From the lake ports a large proportion of the peach crop is shipped to Milwaukee and Chicago for distribution, but from the interior places of shipment, peaches are distributed in every direction by rail. The development of the small fruit interest for market has been in the region of large cities and lake ports. From the cities at the mouth of the St. Joseph river, in the height of the small fruit season, it is not rare to have the shipments aggregate 20,000 bushels a day. The grape industry is widely scattered over the southern half of the lower peninsula. The country bordering on Lake Erie, from the character of the soil, has produced the finest quality of fruit. In recent years a great impetus has been given to this industry in the vicinity of Lawton, Van Buren county, from which point hundreds of carloads are shipped annually. Plums are grown over a large portion of the southern peninsula, and to some extent, in the northern peninsula, but the fruit reaches its greatest perfection in Oceana and Mason counties.

The wide range of horticultural products grown in this state, and the wonderful development of certain specialties, in localities suited to them, have been due to the admirable method of disseminating exact and valuable information upon horticultural subjects in every corner of the state. This has been accomplished by organization. The state horticultural society, with its numerous branches; the organizations devoted to commercial horticulture; granges, farmers' clubs and institutes, touching in their work, according to locality, the various branches of horticulture, have all been valuable means for disseminating information. The Fruit Catalogue of the Michigan Horticultural Society has been a text-book for every planter; this, in recent years, has been supplemented by admirable bulletins from the horticultural branch of the state experiment station; and the men who have entered horticulture as a profession, becoming leaders, have been singularly public-spirited and well equipped. Michigan fruit-growers have never been guilty of neglecting to exhibit their products in attractive ways at county, state, national, and even international expositions, thus creating a demand for information which could be readily supplied in the form of bulletins, reports, circulars, etc., by their progressive organizations.

Certain crops that were in early days considered to be simply garden products have developed to such an extent that now they are field crops; this is notably true of celery, chicory, mint, potatoes, cabbages, tomatoes, cucumbers and melons. The quick and satisfactory communication from the lake ports with the large cities of Illinois and Wisconsin has stimulated the culture of the muskmelon and tomato to such an extent that they are not now reckoned as garden crops. Kalamazoo celery is shipped over a large area of the civilized world. The soil seems admirably adapted to the production of a high grade of product, and the method of growing and handling has reached far toward perfection. It is true, also, that other points in the state are developing as celery centers, and giving their names to the exported

product; this applies to Grand Haven, Muskegon, Tecumseh, Ypsilanti and Ionia.

The lettuce industry, conducted under glass, has reached an extraordinary development in the vicinity of Grand Rapids, a variety having originated there admirably suited to the purpose, and at this writing half a million feet of glass are devoted to this crop. Recently, the plaster caves at Grand Rapids have been found to be suited to the growth of mushrooms, and this is a growing horticultural industry. The glass structures devoted to lettuce are used for the growth of cucumbers, to supplement the lettuce crop, thus reudering it possible to utilize the glass for nine or ten months in the year. Parsley has also become a remunerative crop under glass, and the shipments to the large northern cities are rapidly increasing.

The flower trade is confined almost entirely to glass structures, and depends upon the wholesale market to take care of the output. Chicago seems to absorb everything of this kind in the western part of the state, while Detroit draws its supplies from the southeast portion. The carnation is the leading flower for export, and the soil of certain localities in western Michigan seems especially adapted to securing perfection in the flowers. Roses and violets in aggregate shipments follow the carnation closely.

1399. Michigan, showing horticultural areas.

The upper peninsula, as yet, is somewhat of an unknown quantity in horticulture, and still there are indications that in some localities the hardier fruits may be grown with the greatest success; from the market point of view, the small fruits, coming into the large centers late in the season, bring a remunerative price and extend the season. It is predicted by thoughtful horticulturists that because of the rapidity of development and marvelous growth in the short northern season, the upper peninsula will evolve a remarkably remunerative horticulture, peculiar to itself. The selection of varieties of the more perishable fruits, like berries and peaches, is modified largely by the fact that it is desirable to avoid competition with the flood of fruits from the South, so that the later ripening varieties are generally most popular with the market growers.

One of the important factors in fruit-growing along the shore of Lake Michigan is the tremendous volume of resort business. The whole shore, from St. Joseph to Mackinac, is dotted with resorts, and this population demands plenty of fruit of good quality, making the home market of no mean proportions. Nature designed Michigan for horticultural pursuits, and the progress of population has brought the right spirit into the culture of orchard and garden products. Everything indicates a most promising future for Michigan horticulture.

CHARLES W. GARFIELD.

The soil and climate of Michigan are well adapted to the production of high-grade seeds of many of our garden vegetables, and large areas are devoted to their cultivation. In 1899 a single firm of seedsmen had contracts with over 1,400 Michigan farmers for growing garden seeds of various kinds, and in 1900 contracts have been let to grow within the state at least 15,000 acres of garden varieties of peas, 10,000 acres of garden beans, 2,000 acres of sweet corn, 1,000 of cucumbers, 1,000 of melons, 500 of tomatoes, and smaller areas of onions, radishes, cabbage, etc., these crops being grown for seed alone. The seedsman contracts with farmers who are good cultivators and have good farms and buildings, to plant a certain area with choice selected seed furnished by the seedsman, who also does all necessary expert work in the roguing and cleaning of the crop and agrees to pay a specified price for all the seed produced. The seeds produced hitherto have proved of such exceptionally good quality that most American seedsmen are coming to depend largely upon this state for their supply of many sorts, and there is a steadily growing demand for Michigan seed for export. W. W. TRACY.

MICÒNIA (D. Micon, Spanish botanist). *Melastomàceæ*. Cogniaux, the latest monographer (DC. Monogr. Phaner. 7) admits 518 species to this genus, including the plants known to the trade as Cyanophyllums. The most popular of these greenhouse plants, *Cyanophyllum magnificum*, is placed amongst the species which are imperfectly known and is not described in the monograph. It was first illustrated and described as long ago as 1859. Miconia is a tropical American genus of trees and shrubs, with large and showy opposite or verticillate, strongly veined lvs. Petals 4–8, rounded at the apex, spreading or reflexed. Stamens variable in number and shape, but usually 8–16, the anthers polymorphous. Fr. a dry or leathery berry, 2–5-loculed, and few- or many-seeded. Fls. relatively small, usually corymbose or paniculate, white, rose, purple or yellow.

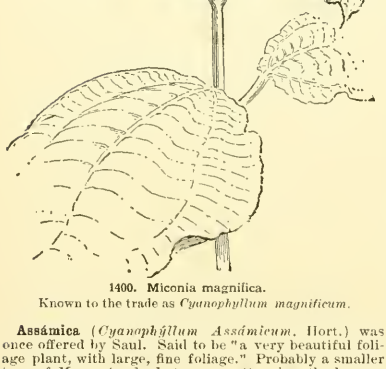
The Miconias of gardeners are conservatory or warmhouse subjects, grown for their large and striking foliage. They belong to the old genus Cyanophyllum, in which the anthers are subulate and incurved and with a single pore, the fls. large and the calyx oblong or campanulate and truncate or dentate. They propagate by cuttings of the firm wood over bottom heat. The plants should be screened from the direct glare of the sun, and be given abundance of water. Use a fibrous soil. Culture similar to that of Medinilla.

Since the plants are known to gardeners mostly for their foliage, it is probable that some of the trade species are referred to wrong genera. Flowers are not always known when the plants are named. Some of the names have no standing in botanical literature.

magnífica, Triana (*Cyanophyllum magnificum*, Gronl.). Fig. 1400. Reaching several feet in height as grown under glass (probably a tree in its native place),

robust: lvs. very large (becoming 2–2½ ft. long), broad-ovate and wavy-edged, arched, rugose, upper surface lustrous green, lower surface red, the very prominent veins white or light-colored: fls. small, panicled. Mex. R.H. 1859, p. 359.—Discovered by Ghiesbrecht and first shown by Linden in 1857. One of the best and most striking of all conservatory foliage subjects. Voss (Blumengärtnerei) revives for this species the genus Tamonea and calls it *T. magnifica*, Voss. **M. velùtina**, Lind. & Rod. (I.H. 41:21), of Brazil, is perhaps a form of this species. Its lvs. are not arched and the colors are more bronzy.

spectánda, Rod. (*Cyanophýllum spectándum*, Nichols.). Lvs. oval, 1½ ft. or less long, 6–7 in. broad in the middle, the upper surface dark lustrous green, the under side greenish red, the midrib prominent and gray. Brazil.



1400. Miconia magnifica.
Known to the trade as *Cyanophyllum magnificum*.

Assámica (*Cyanophýllum Assámicum*, Hort.) was once offered by Saul. Said to be "a very beautiful foliage plant, with large, fine foliage." Probably a smaller type of *M. spectanda*, but very pretty when the lvs. are expanding. Said by Nicholson and Mottet to be much inferior to the above. L. H. B.

MICROKÈNTIA (Greek, *minute Kentia*). *Palmàceæ*. Here may belong the plant known to the trade as *Kentia gracilis*. Microkentia is a genus of 6 species of palms from New Caledonia. They are unarmed, with slender, bamboo-like, ringed trunks. The leaf segments are long-sword-shaped and distinct, or the upper ones grown together into a broad 2-cut blade. The fruits in this genus are amongst the smallest in the palm family. The fls. also are minute. The true Kentias, of which perhaps none is cultivated, have larger fls. and fruits, the former white, the latter vermilion. The anthers are fixed at the base in Kentia, but dorsifixed and versatile in Microkentia. Microkentia is nearer Clinostigma and Cyphosperma, but in these the leaf segments are irregularly bitten off at the apex. *Kentia gracilis*, Brong. & Gris. = *Microkentia gracilis*, Benth. & Hook. It is possible that the *Kentia gracilis* of the trade is *Kentiopsis divaricata* (which see).

MICROLÈPIA (Greek, *a small scale;* alluding to the indusium). *Polypodiàceæ*. A genus of graceful greenhouse ferns, allied to Davallia, but having the shallow, half-cup-shaped, membranous indusium attached to the sides as well as the base; the stalks are also continuous with the rootstock, and not joined to them, as in the true Davallias. Twenty or more species are known. For cultivation, see *Davallia*.

A. *Lvs. once-pinnate.*

marginàlis, Baker (*M. scàbra*, Hort.). Lvs. rising from a creeping rootstock, 18–24 in. long, 9–15 in. wide, with linear pinnæ, which are cut about half way to the rachis into bluntish, oblong lobes. Ceylon to China.

B. *Lvs. tri-quadripinnatifid.*

platyphýlla, Don. Lvs. 3–4 ft. long, on stout stalks from a stout, scaly rootstock, tripinnatifid; ultimate divisions broad, bluntish, toothed, oblong, deltoid; sori 2–12 to a segment, one in each tooth. India to Japan.

hírta, Kaulf. Lvs. 3–6 ft. long, on stout stalks, triquadripinnatifid; ultimate divisions oblong, broadly toothed; rachises hairy or pubescent; sori 2–20 to a segment, 1 or more together at the base of the teeth. India and Polynesia. Var. **cristata** is also offered by the trade. F. 1878, p. 59. Gn. 31, p. 428. F. R. 1:769.—*M. cristata*, Hort., presumably belongs here.

M. hispida, Hort.=? L. M. Underwood.

MICROMÈRIA (*mikros*, small, *meris*, a part: small-flowered). *Labiàtæ*. This genus comprises about 60 species of herbs and subshrubs, generally distributed in tropical and temperate regions, especially in the Mediterranean countries. Lvs. usually small, entire or toothed: whorls axillary or in terminal spikes: fls. small; calyx 13-nerved, 5-toothed or 2-lipped, corolla 2-lipped, upper lip erect, flattish, entire or notched, lower spreading, 5-lobed; stamens 4.

A. *Fls. 1–3 in the axils.*

Douglasii, Benth. Yerba Buena. Perennial: stems long, slender, trailing and creeping, with sweet-scented round or oval lvs., 1 in. or less across: fls. purplish, mostly solitary in the axils, on long, 2-bracted pedicels. Woodlands, from Vancouver's Is. to S. Calif. Sandy soil.—Offered by E. Gillett, 1881.

AA. *Fls. numerous in the axils.*

rupéstris, Benth. A dense, low-growing perennial plant, woody at the base, with prostrate stems, which turn up at the extremities, giving a heath-like effect when in bloom. Lvs. have the odor and taste of pennyroyal: fls. abundant, small, white, with lavender spots on the inner side of corolla lobes, borne for several inches along the stems. Prop. from cuttings and seeds. J. N. Gerard writes that it blooms from July until heavy frosts, and proves very satisfactory for rockery and informal border. Not advertised in American catalogues, but is in cult. by amateurs. S. Eu. M. B. Coulston.

MICRÓSTYLIS (Greek, *small style*). *Orchidàceæ*. About a dozen species of this genus are in cultivation in the Old World. No species have found their way into the American trade. They are herbs of terrestrial habit, cult. for their richly colored lvs. The species in cult. are all from tropical countries, and require a close, damp house or, better, a Wardian case or bell-jar, within which the air may be kept moist enough for their requirements. The lvs. are more or less broadly ovate, rather succulent, with sheathing bases. They are mostly beautifully colored. The fls. are borne in terminal racemes, like those of Goodyera.

Heinrich Hasselbring.

The Myerostylis are deciduous orchids. They grow well in the warm end of the cattleya department, or better still treated like thunias or calanthes,—a rather warm, moist atmosphere when growing in spring, reducing the same toward late summer as they begin to lose their foliage, and eventually resting them quite dry in a temperature of about 60° F. during winter. They will probably suffer in a Wardian case or bell-glass. They certainly will after growth is completed, if not at all times. R. M. Grey.

MIGNONETTE (Fig. 1401) is a universal favorite. Though there are many fragrant flowers of easy cultivation that exceed the Mignonette in beauty, it is prob-

able that no other flower is so generally grown for fragrance. No home garden is complete without some Mignonette. It needs a cool soil, only moderately rich, shade part of the day, and careful attention to cutting the flower-stalks before the seeds are ripe. It grows 1-2 ft. high, and is treated as a half-hardy annual. If a sowing be made in late April, followed by a second sowing in early July, the season may be extended until severe frosts. Those who wish to have home-grown Mignonette in the window during winter may sow seeds in pots late in summer. Few flowers will prove as disappointing if the treatment it needs is omitted.

Years ago Mignonette was one of the few fashionable flowers. Every florist grew a little. With the rise of florists' roses, carnations, violets and chrysanthemums the Mignonette lost some of its relative importance, but within recent years a new era has opened for it. It is now a highly specialized crop, being little grown by general florists, but grown on a large scale by a few specialists.

For the botanical status of Mignonette, see *Reseda*.

C. E. Hunn.

Wholesale Cultivation of Mignonette.—Owing to improved methods of cultivation practiced in recent years, Mignonette has become a staple in the cosmopolitan markets. A few years ago growers contented themselves with little attention to the plant, letting it take care of itself after planting the seed in a row along the side of rose beds or benches. Now, however, certain growers having made its cutting and seed a specialty, the result has been the production of improved strains finding such favor that the old, careless methods are abandoned. As yet, well-grown plants in pots are not offered to the public, but the indications are that before long they will take their place as favorite Christmas and Easter plants, for which they are well fitted, since they are useful house plants in their keeping and odoriferous qualities.

Mignonettes in beds or benches for winter-flowering will succeed in almost any soil, but the best is a good, turfy loam, taken from an old pasture plowed as early as possible in spring after the grass begins to grow nicely. In the preparation of this soil, the pasture should be plowed about 4 inches deep and the earth heaped up immediately after plowing. When heaping, a layer of soil should first be made, then a layer of manure, and so on until the heap is completed, the top rounded off a little so as to throw off the surplus water of heavy rains. One load of good cow manure to six of soil would be about the right proportion.

If the plant is grown in beds, eight inches of soil will be sufficient, and the beds should rise slightly from the sides to allow for settling. The rough parts should be raked off, and a board laid on the soil and tramped upon until the soil is firmed evenly. Rake it again to roughen the surface, mark out rows lengthwise a foot apart, with cross rows at the same distance. Sow the seeds in the corners of the square thus made, cover very lightly, and when the sowing is completed, give a light watering with a fine rose watering-pot to settle the soil around the seeds. After the plants are up and growing and have made their second leaves, thin out to one plant, leaving the strongest one. Care should be taken at this time not to over-water, as it is preferable to leave the soil rather dry than wet. As soon as the plants are large enough, stake them all and tie them loosely to prevent them from falling ont.

If the seed is sown in July for a November crop, the ventilators must be kept open day and night so as to admit all the air possible, in order to keep the plants stocky and short-jointed. Temporary shading in the middle of the day when the sun is hot is very necessary.

After the plants begin to show the flower heads, all the side shoots should be removed from around the heads down to the stem. Leave three or four of the strong bottom side shoots to come on for a second crop, and so on as the crop matures. Always have another crop coming on to take the place of the one that was cut. By keeping the plants neatly staked and tied there should be a continuous crop from November to May. When the plants have reached a good size, watering is of the utmost importance and should be done in the mornings and only on bright days, so that the foliage may be dry before night; for if the water lies on the foliage for twenty-four hours the leaves will become spotted and a fungous growth started, to the ruin of the plant. A night temperature of 45°, with a rise of 10° or 15° in the day, suits the plant very well. Mignonette will succeed in almost any kind of a glass structure, but, of course, the better the house the finer the product.

The cultivation of Mignonettes in pots requires much attention, involving careful watering, staking and training of the plants into the shape required. All this takes time, but good specimen plants in pots of 8 inches, with 15–20 heads of flowers to a plant, will repay the grower for all the attention bestowed. The best method for this kind of growing is to fill up 2-inch pots with finely sifted soil from the compost heap described before, then add one-third leaf-soil run through a sieve, with a little sand to make it porous, and then, pressing the soil firm, make a little hole with the finger in the center of the pot, drop in 2 or 3 seeds, cover lightly and water with a fine rose to settle the soil around the seed. After the plants are up thin out to one plant to a pot, leaving the strongest one. Keep all the plants as near the glass as possible to prevent them from becoming drawn. Be careful not to let the plants get dry at this time. If they receive a check at this or any time for want of water they get hard and will never make good plants afterwards.

1401. Mignonette—Allen's Defiance.

When the plants have filled the pots with roots shift to 4-inch pots, using a little rougher soil. Never allow the plants to become pot-bound. Up to this time they will not require stakes if kept near the glass with plenty of ventilation and are carefully watered. When the young roots begin to show through the soil at the sides of the pot shift to 8-inch pots, using good rough soil. Drainage must be provided at the bottom of the pots—broken bricks will answer the purpose. Cover this drainage

material with a little rough stuff from the potting bench and pot the plants firmly, leaving the space of an inch at the top of the pot for water. Watering should be done sparingly until the plants fill the pots with roots. By this time the plants should be 4 inches tall, and the center shoot should now be pinched out to induce enough of the side shoots to form the foundation of the plants. The center shoot will produce 2 or 3 side shoots below where it was pinched, and with 6 or 7 bottom side shoots will form the basis of the plant. Rub off any other side shoots as they appear. After the plants have grown to a height of 6 or 7 inches they must be staked and tied; a stake in the center for the center shoot and one for the side shoots will be sufficient. After the plants have attained a height of 10 or 12 inches, and before the flower heads begin to show, pinch the center out of all the shoots with the finger and thumb at the same time so as to induce the plant to flower all at one time, for if pinched two or three weeks apart the flower heads will come irregularly and the plants will not look so well. As soon as the flower heads begin to show the plants should have a little weak liquid manure twice a week and as they develop and the roots get crowded in the pots they will require more feeding. Put about a bushel of sheep manure in a bag and drop it in a barrel of water for two or three days before using. This makes a very good liquid food for the plants; also chicken manure treated the same way but used in lesser quantity—about a half a bushel to 50 gallons of water will be about right. If the plants have been carefully watered and attention paid to staking and training, the grower will be amply rewarded with nice specimen plants having from 12 to 20 flower spikes to a plant.

Seed-saving.—Plants wanted for seed should be carefully selected. Only the very best plants with clean, healthy foliage and large bracts or flower heads, with the florets set close together, are the ideal plants for seed. If the plants are growing in a house or near other plants that are not so good they should be covered with mosquito netting to prevent the bees from cross-fertilizing them. After the heads have set, say from 20–25 pods, the center should be pinched out, for if allowed to grow and set more the seed will be of an inferior quality. When the seed begins to turn brown in the seed-pods the pods should be picked off and laid in an airy room for a day or two on paper, so that none may be lost. After the pods are dry, so that the seed will rub out clean, the seed should be cleaned, put in a package and placed in tin boxes to keep from mice, as these pests are very fond of it.

ROBERT MCMILLEN.

MIGNONETTE VINE. See *Boussingaultia*.

MIKÀNIA (Prof. J. G. Mikan, of Prague, or his son and successor, J. C. Mikan, who collected in Brazil). *Compósitæ*. This includes *M. scandens*, the Climbing Hempweed, a common native weed, but a pretty one. It has distinct foliage, the lvs. being somewhat heart-shaped or halberd-shaped, and long-acuminate. The fls. are very small, numerous, pinkish, and borne in dense clusters 1–2 in. across. These clusters, as in all the species, are composed of many small heads, each containing 4 fls., surrounded by an involucre of 4 bracts. The genus contains about 60 species, mostly found in the warmer parts of America. Shrubs or herbs, the latter twining, rarely erect: lvs. opposite, usually stalked: heads spicate, racemose, corymbose or panicled: fls. mostly white or yellowish. Nearest to Eupatorium, but the latter has an indefinite number of involucral bracts instead of 4, and contains erect plants.

scándens, Willd. CLIMBING HEMPWEED. Described above. Moist ground, New Eng. to Fla. and Tex. G.W.F. 34.—Very rarely offered by dealers in native plants.

Sánderi, Hort. Hothouse climbers, with variegated foliage. Int. 1899 by Sander & Co., who say the lvs. are richly embellished with dark velvet-purple patches; veins of mature lvs. white. The lvs. are about 6 in. long, 5 in. wide, boldly toothed.

M. violàcea, offered by Pitcher & Manda in 1895, is little known.

MILDEW. This name is given to a group of fungous diseases which attack leaves, shoots, flowers and fruits. The true or powdery Mildews (Erysipheæ) appear as a thin, white, powdery coating on the surface of the plants. The disease is usually accompanied by distortion and dwarfing, and often death of the affected parts. In some cases, however, as in the maple Mildew, the affected areas of the leaves retain their chlorophyl and remain green in the autumn long after the rest of the leaf is dead and yellow. The mycelium is always superficial, forming spots or more or less extended areas on the affected organs. The injury is done by numerous haustoria, which penetrate the cells of the host and absorb nutriment for the mycelium, and also serve as organs of attachment. During the summer Mildews are propagated by 1-celled spores, many of which are cut off in succession from erect, simple branches all over the diseased surface. Other spores, by means of which the fungus passes through the winter, are produced in sacs inclosed within hollow spherical receptacles, called perithecia. These appear as minute black or dark brown specks over the diseased area. They are produced in the autumn, and remain on the fallen leaves; but the spores within them do not ripen until the following spring, when they are liberated by the decay of the perithecia.

In the United States, considerable injury is caused by the following species: The rose Mildew, *Sphærotheca pannosa*, on roses under glass; *Erysiphe graminis* on wheat and other grasses; the vine Mildew, *Uncinula spiralis*, producing the powdery Mildew of grapes; *Podosphæra Oxyacanthæ* on apples and pears; and *Sphærotheca Castagnei*, the hop Mildew. The most successful mode of combatting the Mildews is by dusting with sulfur or spraying with Bordeaux mixture. Either of these fungicides kills the mycelium and spores of the fungus.

The downy Mildews or false Mildews belong to the Peronosporeæ, a group of fungi widely separated from the true Mildews. The mycelium is parasitic within the tissues of the host, only the fruiting branches appearing at the surface (see Fig. 879). The fruiting branches have a characteristic form and method of ramification for each genus of the group. The spores, when they lodge on new host-plants, either produce an infecting thread directly, or, in most cases, the contents of the spore is discharged in the form of swarm-spores, which swim about for a time and finally come to rest and produce the infecting mycelium. Resting spores are produced sexually in this group within the tissues of the host.

This family contains about ten genera, of which the following are most commonly known: *Phytophthora infestans*, the potato blight; *Plasmopara viticola*, the downy Mildew of grapes; *Bremia Lactucæ*, often causing great damage to lettuce in forcing-houses; *Pythium Debaryanum*, causing damping-off of seedling cucumbers and various other seedling plants; and *Cystopus candidus*, the common white rust of crucifers. Modes of combatting these diseases are set forth for each specific case in the experiment station literature of the various states. See, also, *Diseases*.

HEINRICH HASSELBRING.

MILFOIL. See *Achillea*.

MÍLIUM (ancient Latin name of Millet, which, however, belongs to a different genus). *Gramineæ*. MILLET GRASS. Contains 5–6 species distributed through temperate Europe and Asia, one of which is also found in North America, and is occasionally cult. for ornament. Spikelets 1-fld., in diffuse panicles. Empty glumes awnless, the flowering glume coriaceous, as in Panicum. Farmer's Bulletin, No. 101, issued by the U. S. Dept. of Agric. is devoted to Millets (but not to Milium).

effùsum, Linn. A smooth perennial, 3–6 ft. high: lvs. broad and thin: panicle 6–9 in. long.

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MILK PEA. *Galactia*.

MILK VETCH. *Astragalus*.

MILKWEED. *Asclepias* in general; *A. Cornuti* in particular.

MILKWORT. *Polygala*.

MÍLLA (J. Milla was head gardener at the Court of Madrid). *Liliàceæ*. Bentham & Hooker restrict the genus Milla (as Cavanilles, its author, intended) to one species, *M. biflora*. From Brodiæa the genus differs in the fact that the pedicels are not jointed and the perianth segments are always 3-nerved. Milla and Brodiæa are native to the northern half of the western hemisphere. In South America is the genus Triteleia, which is by some referred to Milla, by others to Brodiæa, and by still others kept distinct. There is one Triteleia (*T. uniflora*) in common cultivation. In his monograph (Journ Linn. Soc. 11, p. 378), Baker refers the Triteleias to Milla, and this disposition is followed by Index Kewensis, but in a later account (G.C. III. 20, p. 459) he refers them to Brodiæa. Watson (Proc. Amer. Acad. Arts. & Sci. 9, p. 240) restricts Milla to one species. The North American plants which have been referred to Triteleia are perhaps best treated as Brodiæas, and they are so considered in the account of that genus in Vol. I of this work. The South American Triteleias are described under that genus in Vol. IV.

Milla has a salverform perianth, with 3-nerved segments which are separate nearly to the base, 6 nearly sessile stamens in one row, sessile, oblong-obovate capsule. **M. biflòra**, Cav., has a scape 6–18 in. high from a small coated bulb, bearing 1–5 (usually 2) star-like, waxy white, fragrant fls. 2–2½ in. across, with oblong-lanceolate segments: lvs. rough, nearly terete. S. Ariz. and New Mex. to central Mex. B.R. 18:1555. F.S. 14:1459. Gn. 24, p. 155.

Milla biflora is one of the best of the small bulbs. It known as Mexican Star, Mexican Star of Bethlehem, Frost Flower, and Floating Star. The fls. are of a charming waxy consistence, and are borne on long stems. They are excellent for cutting, and last several days. Planted in the border early in spring, they soon throw up their fls. and lvs. They should be allowed to remain until September or October, when they may be taken up and stored for the winter. Our gardeners know Milla mostly as a pot bulb for flowering under glass late in winter or early in spring. It blooms readily in the conditions given to Freesias. Several bulbs should be placed in a pot, although several stalks will spring from one bulb.

L. H. B.

MÍLLER, DUSTY. See *Lychnis Coronaria*.

MILLETS are important agricultural grasses. The true Millet or **Broomcorn Millet** of Europe is *Panicum miliaceum*. The common Millets of the United States, the **Foxtail Millets**, are forms of *Setaria Italica*. **African Millet**, also called Black, Chinese, Indian, and improperly Pearl Millet, is *Sorghum vulgare*. The name African Millet is sometimes applied to *Eleusine Coracana*. **Barnyard** or **Japanese Millet** is *Panicum Crus-galli*. **Pearl Millet** is *Pennisetum typhoideum*.

A. S. HITCHCOCK.

MILLÉTTIA (named in honor of Dr. Millett, of Canton, China). *Leguminòsæ*. About 40 species of Old World tropical trees and large shrubs, usually climbers; differs from the Japanese and North American genus Wistaria only in the hard, usually flat and thick pod not opening so readily. Lvs. large, odd-pinnate; lfts. opposite, stipellate: fls. showy, in axillary racemes often fascicled, simple or paniculate and terminal, white, purple or reddish.

A. *Fls. purple.*

Cáffra, Meissn. IRON-WOOD. A South African tree, 20–30 ft. high, with very hard, close-grained, brown wood and dark, rough, rugulose bark. Lvs. on channeled petioles 6–8 in. long; lfts. lanceolate-oblong, acute, in 5–6 pairs, 2–2½ in. long, 1 in. apart; slender stipules 2–3 lines long: panicle 6–8 in. long: fr. leathery, velvety, used as a medicine by the Kaffirs. Int. by Reasoner Bros., 1891.

AA. *Fls. white.*

Japónica, Gray. A Japanese woody climber. Lvs. light green, odd-pinnate; lfts. narrowly ovate, 4–6 pairs, 1½ in. long, 1 in. apart: racemes simple, nodding, 5–8 in. long. Probably not hardy in the North. Procurable of dealers in Japanese plants. S.Z. 1:43 (*Wistaria Japonica*).

MILTÒNIA (named for Lord Fitzwilliam, Viscount Milton, a patron of horticulture). *Orchidàceæ*. This group contains some of the most beautiful orchids in cultivation. The pseudobulbs are closely clustered and sheathed with long, graceful, dark green lvs., forming plants over 1 ft. in diameter, bearing numerous large fls. They are herbs with short pseudobulbs, bearing 1–2 lvs. at the summit and few or many sheathing lvs.

1402. Miltonia vexillaria.

at the base: the inflorescence arises from the base of the pseudobulbs, and consists of a single-fld. peduncle or of a loose raceme of long-pedicelled fls.: sepals subequal, spreading, free or the lateral ones slightly united; petals similar or a little wider; labellum not distinctly clawed, large, expanded, not 3-lobed, but often bifid at the apex: both the segments and the labellum are expanded, forming a flat flower: column short. This genus contains nearly 20 species, mostly from Brazil. They are closely related to Odontoglossum and Oncidium, but may be distinguished by the characters given above. *M. Rœzlii*, *M. vexillaria*, and some closely related kinds were until recently known in gardens as Odontoglossums. In the group containing the "true" Miltonias, the pseudobulbs are separated from each other on the rhizome, and bear 1–2 yellowish green lvs. at the summit and few sheathing lvs. of the same color at the base. The fls. of nearly all Miltonias remain on the plants in a fresh condition for a month or more.

HEINRICH HASSELBRING.

The Colombian species of Miltonia, among which are *M. vexillaria* and *M. Rœzlii*, grow best in a compost of well-chopped, turfy fern root and very coarse river sand or pulverized coal clinkers. Do not overpot. Finish with sphagnum, which should be kept growing. These species should have a temperature of 58° to 70°. They do not like a close atmosphere, but a good and constant circulation of air. Fumigate slightly once a week or scatter strong tobacco dust on the wet, hot pipes frequently to control thrips. After growth is finished, these orchids should be carefully rested in a temperature of 55° to 60°, but at no time should they become very dry.

All the Brazilian kinds enjoy plenty of diffuse, but not direct, sunlight. They need much water while growing. After growth is complete, gradually withhold water supply. The Brazilian kinds grow best in shallow perforated pans, with plenty of drainage, and potted in fern root mixed with coarse leaf-mold and sharp sand.

M. vexillaria, as grown by the respected William Gray, of Albany, was well worth a long journey to see. He had specimens in 12-inch pans in perfect health and condition, which were a lovely sight. When asked for the secret of his notable success, Mr. Gray pointed overhead to the ventilators (outside temperature 20°), which were open just enough at top and bottom to allow a gentle circulation of air. Mr. Gray added that he kept up plenty of atmospheric moisture and was very careful about overhead waterings on close, warm days.

WM. MATHEWS.

Though the genus Miltonia is closely allied to Odontoglossum botanically, the cultural requirements are in many cases very different. Species Nos. 1, 2, 3, 4 and 10 do well under the same general conditions of culture recommended for *Odontoglossum crispum* (which see), but 5° more heat during the winter months should be given them.

M. spectabilis and *M. flavescens* should be grown in baskets or pans suspended from the roof in a compost of clean, chopped peat fiber and live sphagnum, liberally interspersed with pieces of charcoal, to which the roots freely attach themselves. They can, if desired, also be grown on orchid rafts with a little compost between. They require stovehouse temperature, a moist atmosphere and a copious supply of water both at the roots and overhead when growing.

M. candida, *M. cuneata* and allied species thrive best in liberally drained pots or pans in a compost of rough, chopped peat and sphagnum, interspersed with pieces of broken charcoal.

A warm, moist, shady location, such as is afforded in the Cattleya or Cypripedium department, where the temperature can be maintained at 60° to 65° by night and about 70° by day during winter, suits Miltonias best. The compost should never be allowed to become dry during the growing season, and should never remain dry long even when at rest during winter. Overhead syringing is necessary at all seasons to keep down thrip, to which this group is subject. Weak liquid cow manure applied occasionally during the period of growth is beneficial. Cutting the rhizome between the pseudobulbs, partly through, at the beginning of the growing season will retard the sap and often induce the latent eyes to grow, after which time the pieces may be removed and potted up separately. By this means the stock is increased.

R. M. GREY.

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A. *Pseudobulbs crowded, with numerous dark or gray-green sheathing lvs. at the base.*
- B. *Labellum sagittate at the base.* 1. Rœzlii
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AA. *Pseudobulbs situated at intervals on the rhizome, with few yellowish green lvs.*
- B. *Segments of perianth broad, ovate to oblong.*
- C. *Perianth uniformly colored white, rose or purple*..... 5. spectabilis
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CC. *Perianth variegated, yellow and brown or brown and green.*
- D. *Labellum fiddle-shaped* .. 7. Clowesii

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DDD. *Labellum oblong* .....10. Warscewiczii
- 11. Russelliana

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1. **Rœzlii**, Nichols. (*Odontoglóssum Rézlii*, Reichb. f.). Pseudobulbs narrowly ovate, 1–2 in. long: lvs. numerous, slender, 8–12 in. long, narrowly linear-lanceolate: scapes about half as long as the lvs., bearing 2–3 large fls.: fls. flat, 3–3½ in. across, pure white, with a purple band at the base of the petals and a yellow stain, more or less marked with reddish brown, at the base of the labellum; sepals and petals ovate-oblong, acute; labellum large, broadly obcordate, with a tooth in the sinus, and a spur-like horn projecting backwards on each side of the column. Closely allied to *M. vexillaria*, from which it differs in color and by the more slender, nerved lvs. Flowers twice a year in winter and spring. Colombia. B.M. 6085. I.H. 23:228. R.H. 1875:450. Gn. 4, p. 251; 10:31; 26:457.—Var. **álba**, Hort. Fls. large, lacking the purple band on the petals. Gn. 26:457. F.M. 1875:164. A.F. 13:1453. Gng. 6:327.

2. **vexillària**, Nichols. (*Odontoglóssum vexillàrium*, Reichb. f.). Fig. 1402. Pseudobulbs 1½–2 in. long: lvs. 6–12 in. long, narrowly elliptic-lanceolate: scapes sometimes 6 from a single pseudobulb, slender, and longer than the lvs., 3–4-fld: fls. the largest of the genus, flat, about 4 in. long; sepals and petals ovate-oblong or obovate, pale or dark rose, sometimes with white margins; labellum large, rounded, deeply emarginate, narrowed to a sagittate claw, deep rose, whitish at the base, streaked with yellow and red. The fls. are extremely variable in shape and color. Spring and early summer. Western slope of the Andes, Colombia. B.M. 6037. I.H. 20:113. F.S. 20:2058. R.H. 1876:390. Gn. 9, p. 577; 10, p. 108; 17:234; 35, p. 268; 45, p. 536. G.C.II. 26:145; III. 18:743; III. 19:755; 27: May Suppl. J.H. III. 31:301. G.F. 8:195. G.M. 39:386. V. 5:138. A.F. 13:121.—One of the most popular of all orchids. There are several varieties of this plant. Vars. **gigantèa**, **grandiflòra**, **picta**, **rósea**, have been advertised under Odontoglossum.

3. **Éndresii**, Nichols. (*Odontoglóssum Warscewiczii*, Reichb. f.). Pseudobulbs small, tufted: lvs. numerous, distichous, elliptic-lanceolate, about 1 ft. long: scape as long as the lvs., inclined or drooping, 6–8-fld.: fls. 2–2½ in. in diameter, flat, white, with a yellow crest on the labellum and a rose-colored blotch at the base of each segment; sepals broadly ovate; petals elliptic; labellum very broadly fiddle-shaped and 2-lobed. Feb. Costa Rica. B.M. 6163.

4. **Phalænòpsis**, Nichols. (*Odontoglóssum Phalænópsis*, Lind. & Reichb. f.). Pseudobulbs ovate, with grass-like lvs. 8–10 in. long at the base and apex: stalks 1–3-fld., shorter than the lvs.: fls. large, flat, white, with the labellum variegated and streaked with crimson; sepals 1 in. long, oblong, pointed; petals broader and rounded; labellum large, broadened and 2-lobed in front, constricted near the middle and expanded above into 2 rounded lobes. The pseudobulbs are clustered, forming clumps 1 ft. or more across, with numerous fls. mingled with the long, grass-like lvs. Spring and summer. Colombia. I.H. 3:109. Gn. 18, p. 447; 26, p. 232; 35, p. 269; 36, p. 315. G.C. II. 25:364. I.H. 28:417 (var. *luxurians*, more vivid).

5. **spectábilis**, Lindl. Rhizome creeping, with the pseudobulbs placed about 1 in. apart, with 2 lvs. at the apex and few sheathing lvs. at the base: lvs. linear-oblong, 4–12 in. long: scapes erect, sheathed, 6–8 in. long, bearing a single fl. about 4 in. in diameter: sepals and petals oblong, obtuse, slightly waved, white or cream-colored; labellum 2 in. long, very broad in front, pendent, somewhat undulate, rose-purple, with darker veins. The first Miltonia introduced into cultivation. It blossoms in autumn, large plants bearing from 20–50 fls., all opening at once and lasting about a month. Brazil. B.M. 4204. B.R. 23:1992. I.H. 6:216; 12:446 (var. *cereóla*); 14:524 (var. *rósea*); 15:573 (var. *virginalis*). P.M. 7:97. K.W. 1:45 (*Macrochilus Fryanus*). R. B. 1889:25. G.M. 38:642. A.F. 6:631. Var. **bícolor**, Hort. Fls. white, with a violet spot on the labellum. Large-fld. and vigorous. Aug. Var. **Moreliàna**, Hort. (*M. Moreliàna*, Hort.). This variety is very distinct in color. Sepals and petals deep purple; labellum of the same color, veined and shaded with rose. In habit the plant is like the type in every detail. B.M. 4425 (as var. *purpureo-violacea*, Hook.). F.S. 10:1008. I.H. 2:71. Gn.

31:593 (habit poor). F.M. 1874:143. G.M. 40:37. F. 1850, p. 123 (outline). A.F. 6:633.

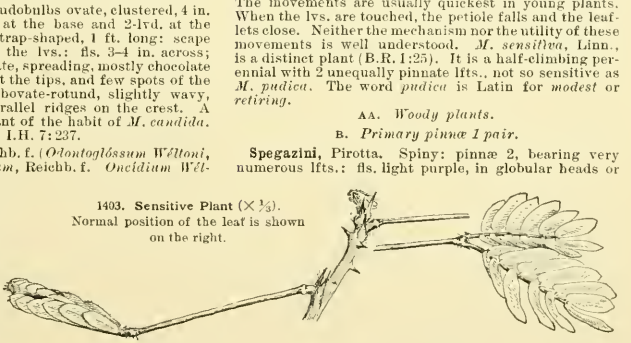
6. **Régnelli,** Reichb. f. Like *M. candida* in habit and foliage: lvs. 1 in. broad; scapes erect, bearing several large fls. over 2 in. in diam.: sepals and petals spreading, recurved at the apex, oblong, acute, white; labellum subpandurate, obtuse or emarginate, rose-purple, with deeper veins and 3 yellow keels at the base. Sept. Brazil. B.M. 5436.—Var. **purpùrea,** Pynært. Sepals and petals tinted with rose, with white margins; labellum crimson, with a white crest. R.B. 17:253.

7. **Clówesii,** Lindl. Pseudobulbs ovate-oblong, leafy at the base and bearing 2 narrow ensiform lvs. at the apex: scape erect, 1 ft. long, many-fld.: fls. 3 in. across, orange-yellow, mottled with brown, the lip white with a violet base; sepals and petals spreading, lanceolate, acuminate; labellum fiddle-shaped, with a cordate base and a broadly rotund, acute terminal portion. Resembles *M. candida.* Sept., Oct. Brazil. B.M. 4109. P.M. 9:241.

8. **cándida,** Lindl. Pseudobulbs ovate-oblong, 2-lvd., with few lvs. at base: lvs. oblong-linear, 1 ft. long, 1½ in. broad: raceme erect, 1 ft. long, 6–8-fld.: sepals and petals spreading, oblong, acute, somewhat wavy, bright yellow, with large red-brown blotches; labellum large, broadly obovate, convolute, crenate and wavy on the margin, white, changing to yellow, with a faint purple blotch. A strange species producing 5–6 racemes, each with 6–10 fls. about 2½ in. across. Autumn. Brazil. B.M. 3793 (var. *flavescens*). P.M. 6:241. Gn. 20, p. 463.

9. **cuneàta,** Lindl. Pseudobulbs ovate, clustered, 4 in. long, sheathed with lvs. at the base and 2-lvd. at the apex: lvs. dark green, strap-shaped, 1 ft. long: scape erect, 5–8-fld. as long as the lvs.: fls. 3–4 in. across; sepals and petals lanceolate, spreading, mostly chocolate brown, greenish yellow at the tips, and few spots of the same color; labellum obovate-rotund, slightly wavy, creamy white, with 2 parallel ridges on the crest. A robust, free-flowering plant of the habit of *M. candida.* Feb. Brazil. B.R. 31: 8. I.H. 7:237.

10. **Warscewiczii,** Reichb. f. (*Odontoglóssum Wéltoni,* Hort. *Oncídium fuscàtum,* Reichb. f. *Oncídium Wéltoni,* Hort.). Pseudobulbs 3–5 in. long, much flattened: lvs. linear-oblong, obtuse, 5–6 in. long: fls. 2 in. long from the tips of the lip to that of the upper sepal, numerous, borne in a branched nodding panicle; sepals and petals cuneate-obovate, waved and crisped, pale reddish brown, with whitish tips; labellum oblong, fan-shaped, bifid, white, with a large rose-purple disk on the center of which is a large, brownish yellow blotch. March. Peru. B.M. 5843. F. S. 18:1831.



1403. Sensitive Plant (×⅓). Normal position of the leaf is shown on the right.

11. **Russelliàna,** Lindl. (*Oncídium Russelliànum,* Lindl.). Pseudobulbs ovate, ribbed, 2-lvd.: lvs. narrowly lanceolate: flower stems dark purple, few-fld.: sepals and petals ovate-oblong, somewhat undulate, brownish purple with green margins; labellum oblong-cuneate, retuse, apiculate, violet, the crests or lamellæ on the disk margined with white. Fls. rather small and dull in color. Dec. Brazil. B.R. 22:1830. P.M. 7:217.

12. **flavéscens,** Lindl. Pseudobulbs narrow: lvs. linear-ensiform: raceme many-fld., the stalk sheathed with bracts: fls. stellate, yellow, with the labellum somewhat spotted with purple; sepals and petals linear-lanceolate, acuminate; labellum pandurate, undulate-acuminate. June. Brazil. B.R. 19:1627. (*Cyrtochilum flavescens*).—Var. **grandiflòra,** Regel. Fls. larger, white at first, becoming whitish yellow; labellum obtuse. Gt. 39:1328.

M. bicolor and var. *candida* are advertised.—*M. Bleuàna,* Hort. (Miltonopsis Bleui Bleu.). Garden hybrid between M. vexillaria and M. Rœzlii. Intermediate between the parents: fls. large, 4 in. across, white, with the bases of the segments tinged with rose-purple; labellum large, bilobed, veined with pink. The sepals and petals are well developed, making a full, rounded flower. A.F. 6:631. G.F. 5:198, 199. A.F. 9:1087 (both var. splendens).—*M. Pùnélli.* No description available.

HEINRICH HASSELBRING.

MIMBRES. *Chilopsis saligna.*

MIMÒSA (Greek, *a mimic,* alluding to the fact that the leaves of some species are sensitive). *Leguminòsæ.* What the florists know as Mimosas are Acacias (chiefly *A. armata*). Mimosa has stamens 10 or less (once or twice as many as the petals); Acacia has numerous stamens. Of Mimosas there are between 200 and 300 species of tropical regions, chiefly of tropical America. Trees, shrubs or herbs (sometimes woody climbers), with bipinnate often sensitive lvs. (sometimes the lvs. reduced to phyllodia): fls. usually with 4 or 5 united petals, and a very minute or obsolete calyx: pollen granular: pod flat, oblong or linear, breaking up into 1-seeded joints when ripe.

A. *Herbaceous plants.*

pùdica, Linn. Sensitive Plant. Humble Plant. Fig. 1403. Cult. as an annual, but probably perennial in the tropics, erect, branching, hairy and spiny: lvs. long-petioled, with 2 or 4 sub-digitate pinnate linear-oblong lfts.: fls. many, in globular-oblong heads on elongating axillary peduncles, purplish: pods comprising 3 or 4 spiny joints. Brazil, but widely naturalized in warm countries. —Easily grown from seeds, which are sold by seedsmen. The plant grows readily in any place in which garden beans will thrive. It is grown for its sensitive foliage. The movements are usually quickest in young plants. When the lvs. are touched, the petiole falls and the leaflets close. Neither the mechanism nor the utility of these movements is well understood. *M. sensitiva,* Linn., is a distinct plant (B.R. 1:25). It is a half-climbing perennial with 2 unequally pinnate lfts., not so sensitive as *M. pudica.* The word *pudica* is Latin for *modest* or *retiring.*

AA. *Woody plants.*

B. *Primary pinnæ 1 pair.*

Spegazini, Pirotta. Spiny: pinnæ 2, bearing very numerous lfts.: fls. light purple, in globular heads or clusters: pod of 3 or 4 parts, spiny. Argentina.—Int. by Franceschi. Small tree.

BB. *Primary pinnæ 2 pairs.*

Guayaquilénsis, Steud. (*Acàcia Guayaquilénsis,* Desf.). Pinnæ 4, with 3–5 pairs of ovate-obtuse glaucous lfts., of which the lower ones are smaller: opposite stipular spines at the base of the leaf. Ecuador.

BBB. *Primary pinnæ 5 pairs.*

Ceratònia, Linn. (*Acàcia Ceratònia,* Willd.). Pinnæ about 5 pairs; lfts. obovate: pods glabrous, somewhat articulate and spiny. Small, spiny tree from W. Indies.

BBBB. *Primary pinnæ 6–8 pairs.*

acanthocárpa, Poir. (*Acàcia acanthocárpa,* Willd. *A. brachyacántha,* Humb. & Bonpl.). Pinnæ 12–14, with 6–15 pairs of oblong-pubescent lfts.: stipular spines 2: fls. in heads on twin axillary peduncles: pod falcate, spiny. Mex.—Bush or small tree.

Dénhardti, Tenore. Ornamental shrub: branches glabrous or minutely hairy, striate, usually bent at each thorn: lvs. hairy, the pinnæ 12–14, the ultimate lfts. small (¼ in. long) and crowded and falcate-oblong-acute: fls. in club-shaped, axillary clusters: thorns 1–3 in. long. S. Amer.—Cult. in S. Calif. Int. by Franceschi.

L. H. B.

MÍMULUS (Latin, *a little mimic*, from the grinning fls.). *Scrophulariàceæ*. This genus includes the Monkey Flower, *M. lùteus*, and the Musk Plant, *M. moschàtus*. Monkey Flowers are something like snapdragons, though they do not have a closed throat. They are 2-lipped fls., with 2 upper and 3 lower lobes, which are all rounded and usually irregularly splashed and dotted with brown on a yellow ground. Though perennial, they are commonly treated as annuals and are considerably used for pot culture in winter, as well as for summer bloom outdoors. The Musk Plant is grown for its scented foliage and pale yellow fls. It is sometimes used in hanging baskets, but the foliage is so sticky that it gathers a great deal of dust.

Mimulus is a genus of about 40 species, mostly American: herbs, decumbent or erect, glabrous or pilose and clammy, rarely shrubby: lvs. opposite, entire or toothed: fls. axillary, solitary or becoming racemose by the reduction of the upper lvs.; calyx 5-angled, with 5 short or long teeth; corolla tube cylindrical, sometimes swelled at the throat; stamens 4, didynamous: capsule oblong or linear, loculicidally dehiscent.

The kinds described below are all perennial at least by underground parts, and most of them are natives of wet and shady places in northwestern America. Latest monograph by A. Gray in Syn. Flo. N. Amer., Vol. II, part I, pp. 273, 442. They mostly grow 2–4 ft. high and bloom all summer. *Mimulus Californica* is advertised. Diplacus is generally referred to Mimulus. W. M.

The sight of Monkey Flowers always carries the writer back to boyhood days. A certain window on his way to school was brightened every spring by a fine display of Monkey Flowers and Musk. Though these two species were thus happily associated, it is doubtful whether the owner knew of their kinship. There is nothing difficult in the culture of Mimulus. Some of the finest plants have been self-sown on a rubbish heap. Abundance of water is essential. The seed has great vitality, and will germinate for many years in the place where once seeds have fallen. They are not hardy.

M. lùteus, with its varieties and hybrids, particularly var. *maculòsus*, is the best known. There are double and hose-in-hose varieties, but the single forms are the handsomest. It often self-sows in moist gardens. *M. cardinàlis*, a handsome Californian perennial, is occasionally hardy, but does best treated as an annual. *M. glutinòsa* is a pretty shrubby species, with coppery fls., once a common greenhouse plant, but rare enough now to be almost a novelty. T. D. Hatfield.

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A. *Color of fls. yellow, brown or brick-red.*
B. *Plants herbaceous.*
C. *Foliage not sticky or clammy..* 1. luteus
2. cupreus
CC. *Foliage sticky and clammy.*
D. *Stamens not thrust out of the corolla.*
E. *Lvs. pinnately veined....* 3. moschatus
EE. *Lvs. parallel-veined.....* 4. Lewisii
DD. *Stamens thrust out of the corolla* ..... 5. cardinalis
BB. *Plants shrubby, at least at the base.*
C. *Lvs. linear, minutely toothed or entire*..... 6. glutinosus
CC. *Lvs. lanceolate, serrate.*
D. *Fls. yellow*..... 7. Clevelandi
DD. *Fls. brick-red*.....8. parviflorus
AA. *Color of fls. violet, purple or lilac.*
B. *Lvs. stalkless: pedicels longer than fls.*..... 9. ringens
BB. *Lvs. stalked: pedicels shorter than the calyx*.....10. alatus

1. **lùteus**, Linn. Monkey Flower. Fig. 1404. Glabrous, the larger forms 2–4 ft. high: lvs. parallel-veined, sharply toothed, upper ones smaller: corolla 1–2 in. long. Alaska to Chile. B. M. 1501.—Monkey Flowers nearly always have yellow throats with brown dots. The lobes are sometimes clear yellow. In var. **rivulàris**, Lindl., only one lobe has a large brown patch. B.R. 12:1030. L.B.C. 16:1575. In var. **Youngeàna**, Hook., every lobe has such a patch. B.M. 3363. B.R. 20:1674. In the common strains these patches are more or less

1404. Forms of Mimulus luteus ($\times \frac{1}{3}$).

broken up and the fls. irregularly mottled and dotted. F. 1863:73 (as *M. maculosus*). V. 10:289 (as *M. hybridus*). A very distinct set of colors is represented by var. **variegàtus**, Hook., the throat chiefly white, but with 2 yellow longitudinal lines dotted with brown on the middle lobe of the lower lip; all the lobes bright crimson-purple, with a violet reverse. B.R. 21:1796. B.M. 3336. L.B.C. 19:1872. Modified as described under var. *Youngeana*. R.H. 1851:261. F. 1850:137. The pictures cited above bear various legends which are not here repeated. The varietal names given above do not appear in the trade, the leading current names being *duplex* (hose-in-hose), *gloriosus*, *hybridus*, *hybridus tigrinus*, *hybridus tigrinus grandiflorus*, *quinquevulnerus maximus*, *tigridioides* and *tigrinus*. Some of these names are advertised as varieties, but all of them usually appear as if they were species. For *M. hybridus cupreus*, Hort., see *M. cupreus*.

Var. **alpìnus**, Gray (*M. Rœzlii*, Hort.). About 2–12 in. high, leafy to the top: stem 1–4-fld.: corolla ¾–1¼ in. long.

2. **cùpreus**, Regel (*M. lùteus*, var. *cùprea*, Hook.). A Chilean species, differing from *M. luteus* in its tufted habit and the fls. yellow at first, finally becoming copper-colored, and the lobes possibly rounder and more nearly equal, the throat yellow, spotted brown. B. M. 5478. Gn. 24, p. 177. R.H. 1883, p. 284.

3. **moschàtus**, Dougl. Musk Plant. Perennial, by creeping stems 1–3 ft. long: fls. pale yellow, lightly dotted and splashed with brown. B.C. to Calif. and Utah. B.R. 13:1118.—This and *M. luteus* have a broad throat. The fls. are normally about ¾ in. across, but in F.M. 1877:248 (var. *Harrisonii*) they are 1½ in. across. Hardy, evergreen trailer for damp, shady spots. Fine for planting under cool greenhouse benches.

4. **Lèwisii**, Pursh. A more slender plant than the next, greener, and merely pubescent: lvs. minutely toothed: fls. rose-red or paler, the lobes all spreading. Shady, moist ground, B. C. to Calif. and Utah. B.M. 3353 and B.R. 19:1591 (both as *M. roseus*).

5. **cardinàlis,** Dougl. Villous: lvs. sharply toothed: fls. red and yellow, the upper lobes much grown together and reflexed, the whole limb remarkably oblique. Water-courses, Ore. and Calif. to Ariz. S.B.F.G. Il. 358. B.M. 3560. R.H. 1857, p. 137. Mn. 8:161. F. 1843:193.—Hardy in Mass., with slight winter covering. Blooms first year from seed.

6. **glutinòsus,** Wendl. Two to 6 ft. high, nearly glabrous but sticky: fls. orange or salmon to pale buff, rather obscurely 2-lipped, the lobes toothed or notched. Rocky banks; common from San Francisco south. B.M. 354 (*M. aurantiacus*). A.G. 12:737. A.F. 12:1107.

7. **Clèvelandi,** T. S. Brandegee. Subshrubby, glandular pubescent: fls. golden yellow. G.F. 8:135.—Cult. only in S. Calif., where it is native. Not advertised.

8. **parviflòrus** (*Diplacus parviflòrus,* E. L. Greene). Rigidly shrubby, but flowering at from 3 in. to 2 ft. Glabrous and glutinous: lvs. narrowly ovate, coarsely serrate: carolla 1 in. long, nearly tubular; lobes quadrate, very little spreading. Santa Cruz Island, Calif.

9. **ringens,** Linn. Stem square: calyx teeth long and awl-shaped: fls. violet. Wet places, Canada to Iowa and Tex. B.M. 283. D. 251.

10. **alàtus,** Soland. Stem somewhat winged or angled: calyx teeth short and broad. Wet places, western New Eng. to Ill., south to Tex. L.B.C. 5:410. W. M.

MÍMUSOPS (Greek, *ape-like,* but application not obvious). *Sapotàceæ.* Tropical trees, with milky juice, of both hemispheres, of about 30 species. Lvs. thick and shining, simple and entire, alternate: fls. perfect, gamopetalous, the corolla of 6 or more lobes, but bearing twice as many appendages in the sinuses, the calyx of 6 or 8 sepals in two rows; stamens usually 6–8, inserted on the base of the corolla; staminodia present; fr. a globose, 1–6-seeded berry, sometimes edible. The Mimusops are fine evergreen trees, good for ornament in frostless countries, and yielding perfumery, rubber and other products. The fls. are small, white, and usually borne in axillary fascicles. Some of the species become more than 100 ft. high, and several of them yield hard and durable timber. A few species have been somewhat advertised in S. Calif. and S. Fla., but their culture in this country is of small account. The Sapodillo is a closely allied tree.

A. *Staminodia (or interior appendages) 2-toothed at the apex.*

globòsa, Gærtn. A large tree, yielding Balata rubber: lvs. obovate or oblong, 2–6 in. long, retuse or apiculate, grayish: calyx of 6 parts, canescent; corolla segments as long as the appendages in the sinuses: fr. often 2 in. in diam., globose. West Indies and Venezuela.

AA. *Staminodia entire or only subserrate.*

Sièberi, A. DC. Becoming 30 ft. tall: lvs. elliptic to obovate, retuse, green, 2–4 in. long, slender-petioled: corolla segments 6, oblong and exceeding the narrow appendages; fertile stamens 6; staminodia short-triangular, nearly entire: fr. nearly 1 in. in diam., brownish or yellowish, said to be edible. Key West to Trinidad.

Elèngi, Linn. Tall tree (becoming 50 ft.): lvs. elliptic and short-acuminate (3–3½ in. long), rhomboid at the base, petiole ¾ in. long: corolla lobes about 6, narrow-lanceolate; fertile stamens 8; staminodia pilose, acute, entire or nearly so: fr. 1 in. or less, ovoid, 1- or 2-seeded, yellow, edible. E. Ind.

díspar, N. E. Brown. Smaller tree than *M. Elengi:* lvs. small, cuneate-oblanceolate, obtuse, rusty-tomentose when young, but become glabrous-green, the petiole ½ in. or less long, and the blade ¾–2 in. long: fls. 12–16, in umbels on the tips of the branches: sepals 6–8, in two series: petals 18–24, in three series, linear-lanceolate, yellow: stamens 6–8: staminodia lanceolate-acuminate, channelled: fr. size of an olive, yellow. Natal.—Int. by Franceschi. L. H. B.

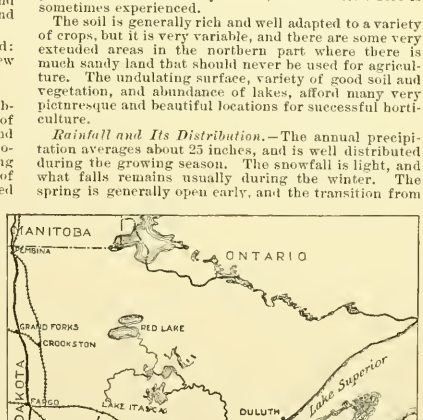
MINA lobata is *Ipomœa versicolor.* **M. sanguinea** is *I. coccinea,* var. *hederifolia.*

MINNESOTA, HORTICULTURAL STATUS OF. Fig. 1405. Minnesota has an area of 84,287 square miles. The surface is gently undulating, except in the extreme northwestern portion, where, in the Red River valley, are large, fertile, level prairies. Its roughest agricultural land is found in the eastern portion, along the Mississippi river, and in many places the bluffs reach a height of 400 feet above the valley. About one-half the state, embracing the northeastern and eastern parts, was originally heavily timbered, and much timber still remains in the northeastern portion, while many scattered groves of timber will be found elsewhere, especially along the rivers.

There are many lakes, the number of which has been estimated at 10,000. They are especially numerous in the central and northern portions, where they greatly modify the climate of lands in their vicinity. There are great variations of climate between the extreme northern half, where the summers are very short, and the southern half, where killing frosts seldom occur before the 1st of October. The winters are generally pleasant, but occasionally severe, and 40° below zero is sometimes experienced.

The soil is generally rich and well adapted to a variety of crops, but it is very variable, and there are some very exteuded areas in the northern part where there is much sandy land that should never be used for agriculture. The undulating surface, variety of good soil and vegetation, and abundance of lakes, afford many very picturesque and beautiful locations for successful horticulture.

Rainfall and Its Distribution.—The annual precipitation averages about 25 inches, and is well distributed during the growing season. The snowfall is light, and what falls remains usually during the winter. The spring is generally open early, and the transition from winter to spring is very rapid. The soil at St. Paul and southward can generally be worked by April 15, and frequently earlier. The summers and autumns are bright and sunny, and vegetation grows with great rapidity.



1405. Minnesota.
Horticultural areas, shown by degrees of shading

Currants, gooseberries, raspberries, blackberries, strawberries, juneberries, Americana plums, and the frost or river-bank grape are native fruits that are found wild in abundance in favorable locations throughout the state. Most of the well-known cultivated sorts of the

five species first named do well under cultivation, and large quantities are raised for home consumption and are profitably marketed. The Concord, Worden, Delaware, and grapes of similar character, are easily raised in the many good locations along the lake shores and the river bluffs, and this is an important industry notwithstanding the fact that they have to be covered in winter, which adds somewhat to the expense of culture. However, on account of the peculiar adaptability of the Delaware grape to some of our soils and to the climate, it is raised with profit in competition with the growers of the eastern states, though the Concord is not high enough in price by one cent a pound to permit of this to any great extent.

Apples are raised on a commercial scale in southern and eastern Minnesota, the high, rolling land in the southeastern portion being especially well adapted to their cultivation. The varieties of the eastern and central states generally prove a failure here. The Duchess of Oldenburg is the standard of hardiness in apples, and can be grown successfully in good locations as far north as St. Paul, and in a small way 100 miles further north. The Talman Sweet is raised to some extent, but is liable to suffer in severe winters. The Minnesota seedling apple known as the Wealthy is generally the most profitable kind grown. (See *Gideon*, p. 642.) Much interest centers around the introduction of varieties of apples of unusual hardiness, and a few of the Russian sorts are proving very satisfactory. The hardiest variety of this origin so far found is the Hibernal, which represents a class of sour autumn apples that will thrive on suitable soil in almost any portion of the state. The Charlamoff is another very hardy early autumn apple of the same class. Such hybrid crabs as the Transcendent, Martha, Gideon No. 6 and Minnesota may be successfully grown in suitable locations and soil over most of the state.

The Americana class of plums is found growing wild all over the state, and the fruit is gathered in large quantities. The cultivated sorts of this class are easily grown everywhere. Wild plums can generally be obtained in abundance in autumn at about $1.50 per bushel. There is no variety of any other class of plums that is appreciably cultivated, although in very favorable locations a few of the Japan and domestic sorts are generally grown.

Cherries may be successfully grown on a large scale in extreme southeastern Minnesota, and there are some commercial orchards; there but generally throughout the state the fruit buds are so injured in winter that the trees are unproductive, although they may make a very satisfactory tree growth.

Pears generally blight to death early, and there is no variety that is generally cultivated. Several of the Russian pears are as hardy as the Duchess apple, but they have died, so far as tried, from blight before becoming very productive. Apricots are not sufficiently hardy.

The most common injury to trees is known as sunscald of the trunks, which often causes severe loss. It is easily avoided by shading the trunks. Blight seriously injures some varieties of apples. Winter protection of various kinds is important and carefully attended to by our best horticulturists.

Vegetables of all the kinds grown in the northern states are very easily raised, and the display of these products in the large markets is very excellent. Cabbage, cauliflower, celery, peas, lettuce, potatoes, beans, corn, cucumbers, tomatoes, squash, watermelons, muskmelons and eggplant are to be had in abundance, and the markets are often glutted with them. Native muskmelons and tomatoes occasionally retail at 10 to 15 cts. per bushel. The canning of vegetables is becoming an important industry at several points. The climate seems to be especially favorable to vegetables, and there is much less trouble from diseases than in many more humid sections.

The demand for ornamental horticulture is considerable and rapidly increasing, giving investment to perhaps $200,000 in the greenhouse business, and adds no small sum to the receipts of the several large and the many small nurseries in the state. The love for horticulture is also shown by the immense sums spent by the cities and small towns for public parks. St. Paul and Minneapolis together have upwards of 3,000 acres in their public parks, which are well cared for, very beautiful, and visited by at least two million persons each year.

The Minnesota State Horticultural Society is a very strong and popular organization, having a membership list of about 800, each of whom pay an annual membership fee of $1. It publishes, at the expense of the state, a monthly journal and an annual report. It also receives aid from the state to the amount of $1,500 annually. It has recently offered $1,000 for a seedling winter apple especially adapted to Minnesota conditions. Great interest is taken in the raising of seedling apples, and at some of the state fair meetings more than 300 separate varieties of Minnesota origin have been shown.

The state experiment station is located near St. Paul and pays considerable attention to horticulture. It has

1406. Four-O'Clock—Mirabilis Jalapa.
Nearly natural size.

four sub-experiment stations, located in various parts of the state. One of these is located at Owatonna, and is devoted almost exclusively to the raising of seedling apples. The Agricultural Department of the university had over five hundred in attendance in the school year of 1899–1900. Four hundred of these attended the agricultural high school, where, in addition to the other agricultural studies, much attention is paid to horticulture and forestry.

SAMUEL B. GREEN.

MINT. See *Mentha*.

MINT GERANIUM. *Chrysanthemum Balsamita*, var. *tanacetoides*.

MIRABILIS (*Admirabilis*, meaning wonderful, strange; shortened by Linnæus to Mirabilis). *Nyctaginàceæ*. About 10 species of the warmer parts of America,

4 of which are cultivated for their pretty or showy fls The fls. have no corolla, but the calyx is colored and tubular and exactly like a corolla in appearance. The fls. are surrounded by a leafy involucre, and sometimes (as in *M. Jalapa*) only one flower is borne in an involucre simulating a corolla in a 5-cleft calyx. The stamens are 5 or 6, as long as the perianth, their filaments united at the base. Style 1, with a capitate stigma. Fruit hardened, capsule-like and indehiscent. They are perennial herbs, although grown as annuals from seeds, with lvs. petioled and opposite, and fls. solitary or paniculate and nearly or quite sessile in the involucres.

A. *Involucre containing only one flower: plant glabrous or very nearly so.*

Jalápa, Linn. FOUR-O'CLOCK. MARVEL OF PERU. Fig. 1406. Erect-bushy, quick-growing herb, germinating readily from the large, conical-oblong fruits, 2–3 ft. high, bearing profusely in late summer and fall long-tubed funnelform fls. in white and shades of red and yellow, and striped, opening in cloudy weather or late in the afternoon (whence the common name Four-O'Clock), and closing in the morning. Lvs. ovate-lanceolate, short-petioled, acuminate, entire: fls. in clusters amongst the lvs.; stamens not exserted. Tropical Amer. B.M. 371.—Cultivated from early times, and always a favorite. In tropics it has tuberous roots, and these were once supposed to be the source of Jalap, whence the name *Jalapa*. There are dwarf and compact varieties; also forms with variegated foliage. The Four-O'Clock is an "old-fashioned flower." It is treated as a tender annual. Thrives in any garden soil. A useful plant for growing in a hedge (plants 1 ft. apart) at the rear of the flower-garden. It sometimes comes up in the spring from self-sown seeds. Even as far north as New York, it often produces tuberous roots large enough to be lifted and stored like dahlias.

AA. *Involucre containing 1–3 fls.: plant viscid-pubescent.*

Califórnica, Gray. Plant 1–3 ft. tall, yellowish green, the many stems ascending from a somewhat woody base: lvs. thick or almost fleshy, ovate-oblong to round-ovate, short-stalked: involucres 5-cleft, short-peduncled, containing 1–3 rose-purple fls. a half-inch long, with stamens sometimes protruded. S. Calif. to Utah and S.—Little known in cultivation.

AAA. *Involucre containing 3 or more long-tubed fls.*

multiflòra, Gray. Stout and tall (2–3 ft.), much-branched, somewhat pubescent or sometimes glabrous: lvs. rather thin, gray-green, lance-ovate to broad-ovate, more or less cordate, short-stalked, acute or acuminate: involucre ¾ in. long, stalked: fls. 6, with a tube often 2 in. long, rose to purple, the style and the 5 stamens protruded.—Var. **pubéscens,** Wats. (*M. Fræbelii,* Greene), is very pubescent throughout. The *M. multiflora* of B.M. 6266 is probably this variety. The species ranges from Colo. to S. Calif. and S. Little known in cult.

longiflòra, Linn. Plant 2–3 ft., glandular-pubescent above: lvs. cordate and usually acuminate, short-stalked, pubescent: fls. pubescent, with a very narrow tube 5–6 in. long, and a small, flaring white, rose or violet limb, very fragrant at evening. Mexico.—An old garden plant, but less frequent than *M. Jalapa*. Easily grown from seeds. It has been hybridized with *M. Jalapa*.

L. H. B.

MISCÁNTHUS (Greek, *miskos,* a stem, and *anthos,* a flower). *Gramíneæ.* EULALIA. Comprises about 6 species in southern and eastern Asia, several of which are cultivated for ornament. Tall perennial grasses with ample terminal fan-shaped panicles, allied to the sugar cane and Erianthus. Includes the Eulalias of the trade but not Eulalia, Kunth, which is referred to Pollinia, Trin., by Hackel. Spikelets 1-fld., in pairs at the joints of the rachis, one nearly sessile, the other pedicellate, usually awned. Glumes 4. A cluster of silky hairs arises from the base of the spikelets, which gives the panicle its beautiful feathery appearance. Increased by seed or division of roots.

Although many progressive nurserymen now advertise these favorite grasses as Miscanthus, the name Eulalia will probably remain in the English language as a thoroughly naturalized word, like Geranium and Chrysanthemum. Eulalias probably rank among the first half

1407. Miscanthus Sinensis.
Which, under the name of Eulalia, is one of the most popular of ornamental grasses.

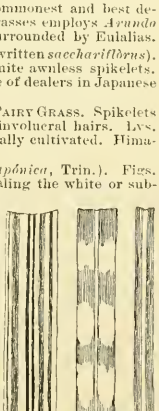
dozen most popular grasses cultivated for ornament. They are remarkably hardy and are universal favorites for bedding. One of the commonest and best designs for a bed of ornamental grasses employs *Arundo Donax* as a tall center piece, surrounded by Eulalias.

sacchárifer, Benth. (sometimes written *sacchariflòrus*). Distinguished by its nearly or quite awnless spikelets. China. Gt. 1862:357.—Procurable of dealers in Japanese plants.

Nepalénsis, Hack. HIMALAYA FAIRY GRASS. Spikelets one-fourth as long as the brown involucral hairs. Lvs. smooth on the margin. Occasionally cultivated. Himalayas.

Sinénsis, Anders. (*Eulàlia Japónica,* Trin.). Figs. 1407, 1408. Spikelets about equaling the white or sub-violet involucral hairs. Culm 4–9 ft.: lvs. 2–3 ft., margins scabrous: panicle 6–12 in., formed late in the season. Established plants form clumps as much as 18 ft. in circumference. The forms in cultivation are mostly the following varieties: Var. **variegàtus,** with leaves striped; **zebrìnus,** leaves banded. These two varieties are not quite so hardy as the type, and are usually propagated by division, as the seeds are not so sure to come true. Gng. 4:375; 6:107. B.M. 7304. Var. **gracillimus** (*Eulàlia gracillima univittàta, E. Japónica gracillima,* etc.). Leaves much narrower than the type. Gn. 50, p. 108. Gng. 5:273. R.B. 21, p. 179.

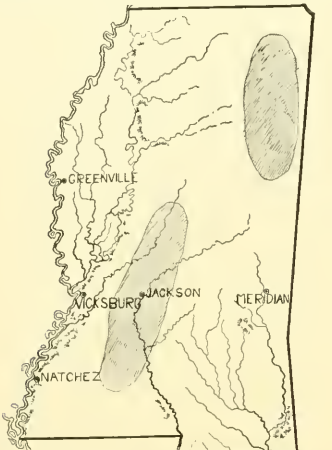
A. S. HITCHCOCK.



1408. Variegation in Miscanthus Sinensis.
At the left, *variegatus;* middle, *zebrinus;* right, *gracillimus.*

MISSISSIPPI, HORTICULTURE IN. Fig. 1409. Mississippi extends about 325 miles from north to south and 175 miles from east to west. The surface is mostly undulating, with few abrupt hills, and the highest part of the state, the northeastern section, is less than 1,000 feet above the sea level. It has an annual rainfall of about

45 inches in the northern part, the amount increasing to about 60 inches in the extreme south. The winter temperature is rarely as low as zero in any portion of the state, while the extreme summer heat rarely reaches 100° in the northern part; while near the Gulf coast 95° is the usual limit. The first frosts usually occur in November, and spring frosts are rare after the middle of March. The soil is extremely variable. The western portion of the state, known as the Yazoo Delta, has one of the richest alluvial soils in the world, and one well suited



1409. Mississippi, showing horticultural areas.

for the growing of vegetables. The north-central part of the state consists largely of yellow clay hills, not very fertile and liable to serious injury from erosion, but with very fertile valleys between them, while the northeastern section has a strong lime soil which is very productive. Nearly all of the southern half of the state has a sandy loam soil underlaid with clay at a depth of a few inches, making those lands among the most desirable for the cultivation of either fruits or vegetables.

Although both fruits and vegetables are grown for export in all parts of the state, there are three districts in which horticultural work is specially prominent. These are (Fig. 1409):

1. The northeastern district, covering the territory along the Mobile and Ohio railroad from Booneville south to West Point.
2. The central district, covering the territory along the Illinois Central railroad from Durant south to Brookhaven.
3. The Gulf coast district, covering the territory along the Louisville and Nashville railroad from Bay St. Louis east to Orange Grove.

Peaches are grown more extensively than any other fruit, and are shipped to northern markets from nearly or quite every county in the state. The long growing season enables the trees to come into bearing rapidly, and a small crop of fruit is usually gathered the second year from planting, while the trees often continue fruitful from 15 to 20 years. Although the trees themselves are never injured by cold, the fruit crop is occasionally cut short by spring frosts following warm winter weather, which sometimes brings the trees into bloom before the end of January. The early fruit is ready for market about the last of May, and shipments continue from that time until August, or later. Elberta, Mountain Rose, Georgia Belle, Lilly Miller and Chinese Cling are among the more popular varieties.

Pears grow well in all parts of the state, and, until about 1895, were planted more widely than any other fruit trees, but since that time the blight has been so widespread and so severe that very few new orchards have been planted. Fully nine-tenths of the trees are either Le Conte or Kieffer, the latter being the more resistant to blight.

Apple trees make a fair growth and bear well for some years, but become less vigorous with age, and are shorter lived than in more northern latitudes. Nearly all varieties ripen during the summer and fall, and very few, even of the "long keepers," can be preserved through the winter. The fruit always commands a high price in the local markets, which makes the trees profitable, even though they last but a few years. Considerable fruit, mostly Early Harvest and Red June, is shipped from the northeastern district, but no other part of the state produces enough for a home supply.

Plum trees are of uncertain value. The Wild Goose and the Japanese varieties are the more common sorts, and while some trees and some orchards may grow well and bear heavily for many years, the majority succumb after producing two or three crops. Cherries are rarely successful. Figs are grown quite commonly for home use in the central part of the state, and in the Gulf coast district are an important market crop. The fig does not succeed under orchard conditions, but a few trees grown near the house do well, and many of the older trees produce 1,000 pounds or more of fruit annually, and this finds a ready market at the canning factories. The Celeste is the common variety, and the demand for the fruit at 4 cents per pound is far in excess of the supply. Oranges are grown along the Gulf coast, but even there the winters are occasionally so cold as to make them unprofitable.

Among the small fruits strawberries are the most important, being grown by thousands of acres. They are grown more extensively in the central district than elsewhere, though there is a considerable acreage in the northeastern district also. In the Gulf coast district the plants grow well and bear abundantly, but the fruit grown there is usually softer and less desirable for shipping than that grown in drier localities. Bubach, Crescent, Gandy, Warfield and Michel are the favorite varieties. Shipments begin about the first of April, and the bulk of the crop is gathered during the next six weeks, though occasional shipments are made during every month of the year.

Grapes grow and bear as well as it is possible for them to do in any part of the country. The long season for growth develops very strong vines which are never injured by the cold of winter, and the latest ripening sorts have ample time for maturing. The early varieties ripen about June 20 in the Gulf coast district, and about July 10 in the northeastern district, and nearly all the crop is gathered by August 1. This early ripening of the fruit enables the grower to secure high prices for his early shipments, but a crop which matures in the heat of midsummer cannot be kept profitably, even in cold storage, but must be marketed at once, regardless of price. Champion, Ives, Delaware, Niagara, Perkins and Herbemont are among the more popular varieties. The Seuppernong (*Vitis rotundifolia*) is a valuable native species which is grown in all parts of the state for home use and for the manufacture of wine, but is not a shipping variety.

Blackberries and dewberries grow spontaneously in all parts of the state and have proved quite profitable in cultivation, the Lucretia, Dallas and other hybrids being the favorite varieties. Neither currants nor gooseberries do well in any part of the state, as they make a new growth and come into bloom soon after the fall rains begin, and soon become so weakened as to be worthless. Raspberries do well when planted on soils containing sufficient moisture, but are seldom grown for market excepting in the northeastern district. Turner is the favorite variety, and the blackcaps are rarely seen.

The growing of early vegetables for northern market is followed more extensively and is more generally prof-

itable than is the growing of fruits. Field plantings of radishes, peas and other hardy sorts begin in January. Shipments begin by the first of March and continue until the melon crop is harvested in July. The first crop of Irish potatoes, mostly Early Ohio and Triumph, is ready for market in May, and in August a second crop is often planted which matures in November, when it finds a ready home market, or is left in the ground until early spring, when it is placed on the northern markets as "new potatoes just received from Bermuda," and brings a high price. This second crop, however, is uncertain, as it is difficult to secure a prompt growth if seed from the early crop is used, and it is often impossible to secure northern seed so late in the season. Sweet potatoes are grown in all parts of the state, and are shipped from July until March. Asparagus is a profitable early crop which is grown quite largely in the central district, and seems wholly free from rust or other diseases. Rhubarb is unable to endure the heat of the long summer, and the roots soon decay. Beans, beets, cabbages, peas, radishes and turnips are all grown so largely as to be shipped in car-load lots from a number of towns in the northeastern and central districts. The crop grown more widely than any other is the tomato, which is grown in all parts of the state, and which is shipped by the car-load to all parts of the country from Boston to St. Paul, Omaha and Denver. Many single growers ship by car-lots, and in June from 10 to 20 cars are shipped daily from Crystal Springs, with nearly as many from Madison Station and Booneville, besides smaller shipments from many other points.

From the central district, shipments are made about as follows:

Beans, May 10 to June 10.
Beets, April 20 to June 15.
Cabbage, May 1 to June 5.
Carrots, April 20 to June 10.
Melons (Gem), June 20 to July 20.
Peaches, June 1 to August 1.
Peas, March 25 to April 25.
Potatoes, Irish, May 10 to June 15.
Radishes, March 1 to April 15.
Squash, Summer, May 15 to June 15.
Strawberries, April 1 to May 10.
Turnips, March 20 to May 15.
Tomatoes, May 25 to July 4.
Watermelons, July 1 to August 1.

There are a number of canneries in the state, the most successful being those at Booneville and Biloxi, but ordinarily growers find it more profitable to ship products to northern markets than to sell at prices which canners can afford.

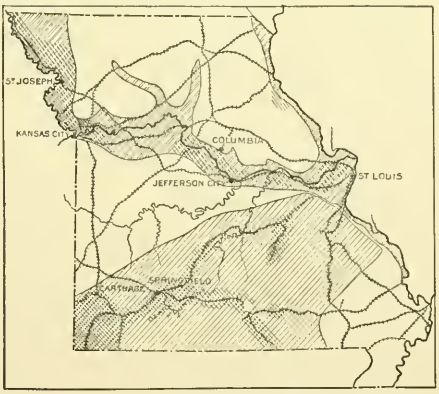
No statistics are available on which definite statements of the total shipments from the state can be based. Crystal Springs, in the central district, probably ships more than any other single point. The shipments of fruits and vegetables from that place amounted to 638 cars in 1898, while in the very unfavorable season of 1899 the number fell to about 400. Partial reports from other points indicate that shipments, in car-lots, amount to not less than 5,000 cars annually, in addition to nearly as much more which is shipped in small lots. The northeastern and central districts ship principally to northern markets, while the Gulf coast district finds its markets in Mobile, New Orleans, and on the many foreign vessels loading in Ship Island harbor. Nearly the entire business has been developed in the last 15 years, and each succeeding year shows a marked increase in its volume. New localities are being opened, the work is becoming better organized, and, with the increase of the business the markets are becoming more steady, prices more uniform, and the profits more satisfactory than in the early days. The business has by no means reached its full development, and will not do so for years to come.

S. M. TRACY.

MISSOURI HORTICULTURE. Fig. 1410. Its central position gives Missouri a medium climate, favorable to the growth of a variety of horticultural products. The native flora embraces both northern and southern plants. The wild American crab and the Juneberry, capable of enduring the rigors of a northern winter, flourish here in the same forests with the more southern persimmon and papaw. The northern grapes of the Labrusca type, like Concord, are among the standard varieties, while on the other hand, the more tender *Vitis rotundifolia*, of which the southern Scuppernong is the most familiar cultivated sort, grows wild in the rich river bottoms. While the berries and small fruits common to the northern states endure well the warmer climate of Missouri, the oriental persimmon and English walnut are hardy as far north as the central part of the state.

Missouri's central position is also favorable to the marketing of her fruit. Berries and peaches are sent to nearly all the principal markets east of the Rocky mountains from Boston and Baltimore on the east to Omaha, Denver and Pueblo on the west, and from St. Paul and Detroit on the north to Mobile, New Orleans and Galveston on the south. The grain-raising, mining and grazing states to the west and northwest, where but little fruit is produced, furnish a growing market for Missouri fruit. The Mississippi and Missouri rivers, touching the entire length and breadth of the state, give cheap freight rates north, south and northwest, while direct railroad connection with the Gulf ports affords cheap shipments of apples to European markets.

The following figures give the average monthly rainfall in inches for the past six years, recorded at Columbia by the U. S. Weather Bureau:



1410. Missouri.

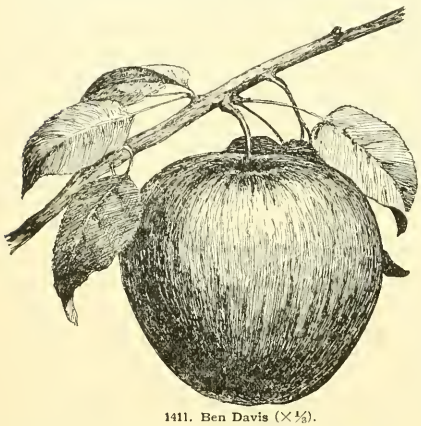
The diagonal shading in the southern half designates the Ozark uplift. The double-line shading along the Mississippi and Missouri rivers shows the loess formation. The short-line cross-shading designates the parts where fruit-growing is most developed.

Jan., 1.89; Feb., 2.57; March, 2.97; April, 4.52; May, 5.87; June, 4.56; July, 4.85; Aug., 2.81; Sept., 3.60; Oct., 1.40; Nov., 2.87; Dec., 2.02.

While these figures show that the rainfall is ample, and well distributed throughout the year, the records also show that the percentage of sunny days in this immediate section is high. During August, September and October especially, when most of our fruit is maturing, the average amount of bright sunlight is considerably higher than that of the majority of our orchard states. No doubt the intense sunlight and proximity to the airy prairies are important factors in producing the rich color and high flavor of Missouri fruit, and may also account, in part, at least, for its comparative freedom from many of the fungous diseases which are known to thrive best in a moist, cloudy atmosphere.

The topography and soil of the state are both favorable to fruit-growing. The undulating areas, intersected by the Mississippi and Missouri rivers and their tributaries, are amply provided with both soil and atmos-

pheric drainage. The soil varies from the light, deep flinty soil of the Ozarks, and the drift of the "loess" formation (see *Iowa*), to the rich soil of the prairie openings and still heavier soils of the river bottoms, and the swamp lands to the southeast, affording choice for different purposes. The immense crops of corn and garden vegetables, sometimes grown in young orchards, and the clover and cow peas, grown to prevent washing of the soil in steep hillside orchards, prove (perhaps too frequently), that even the so-called "fruit lands" are capable of yielding a great variety of products. In



1411. Ben Davis (×⅓).
One of the "big red apples" of the Ozarks.

fact, one great reason why Missouri has not earlier taken front rank as a fruit state is because natural conditions for general agriculture are too favorable. It requires too great an effort to exclude the encroaching blue grass and live stock from orchard areas where thrifty young trees fruit themselves to death in the unequal struggle for existence and the reproduction of their kind.

The last report of the Missouri State Horticultural Society (1897) contains Secretary Goodman's estimate of the quantity and value of fruit produced in the state that year, as follows: Apples—north Missouri, 2,500,000 barrels; central Missouri, 3,500,000; south Missouri, 3,000,000; total value of apples, $12,000,000. Peaches —north Missouri, 500,000 bushels; central Missouri, 1,000,000; south Missouri, 2,000,000; total value of peaches, $3,500,000. Total value of berries, $2,500,000. Total value of pears, cherries, plums and grapes, $1,500,000. These, with nuts and miscellaneous fruits, reach a total value of $20,000,000 for the Missouri fruit crop for 1897. This report is based upon figures obtained from the various railroads and shippers, and may be relied upon as being approximately correct. Considering the fact that a few years ago Missouri could hardly lay claim to being a great fruit-producing state, the above figures indicate very rapid growth of the industry in recent years. In 1898 more young trees were planted than in any previous year, showing an accelerating tendency toward this line of business. A number of orchards in the state comprise over one thousand acres each. The size and number of these large orchards is annually being increased.

It will be seen that the apple is the leading fruit, exceeding in value all other kinds combined. Careful study shows that other things being equal, the best prices prevail in those parts of the state where the most apples are grown, and where, consequently, there is the sharpest competition among buyers. The peach ranks second in importance, and the berries third. The city of Sarcoxie shipped 239 car-loads of strawberries in 1897, and now 1,500 acres of strawberries are growing in its immediate vicinity. Liberal is one of the largest blackberry centers. Hermann and several points in the Ozarks manufacture large quantities of grape wine.

Aside from the work of the Agricultural College and Experiment Station in the promulgation of horticultural work, the Missouri Botanical Garden at St. Louis, being of international influence and importance, cannot fail, with its splendid equipment and able management, to lend an especially strengthening influence to the horticulture of the state in which it is located. The Missouri State Horticultural Society, with nearly one hundred local societies as auxiliaries, under the competent leadership of its officers and organized effort of its members, is doing much toward the development of horticulture.

While horticulture is already one of the leading interests of Missouri, the possibilities of the state in that direction have not yet even been approached. Only a small portion of the soil naturally well adapted to fruit culture has ever been cultivated, and there are many phases of horticulture that have not been developed. In recent years, however, steps in advance are rapidly being taken. The best growers no longer cling to ancient traditions and obsolete practices, but are evolving methods adapted to the new conditions of the West. Capitalists of extensive business training are investing in orchards, and their business ability, combined with the skill of the practical grower, is resulting in better marketing and general management of the industry. New varieties, better adapted to local conditions, are being originated. Our native fruits and nuts are receiving attention, and improved varieties of these are already the result. The working up of surplus and inferior fruit by canning, evaporating, cider and wine-making and distilling is increasing the value of the fruit product, and the canning of tomatoes, peas and other garden vegetables is quite extensively carried on in some sections. In fact, the horticulture of the state is in a rapidly growing condition, and bids fair to reach very important proportions. J. C. WHITTEN.

MISTLETOE of the Old World is *Viscum album;* of America, *Phoradendron flavescens.*

MITCHÉLLA (Dr. John Mitchell, of Virginia, one of the first American botanists; correspondent of Linnæus). *Rubiàceæ.* This includes the Partridge-berry, one of the prettiest and hardiest of native perennial trailers. It has small, shining, evergreen, roundish lvs., sometimes marked with white lines, and bright scarlet berries, often borne in pairs, which remain all winter and make a charming effect when peeping through the snow. This plant can be easily collected, and is also procurable from many dealers in hardy plants. It thrives under evergreen trees, forming dense mats. The fls., which are borne in spring, are small, white, with pinkish throats, and are fragrant. The berries are edible, but nearly tasteless. Fls. twin, the ovaries united into one; calyx 4-toothed; corolla funnel-shaped, 4-lobed; lobes spreading, densely bearded inside, valvate in the bud: fr. a 2-eyed berry.

1412. Partridge-berry—Mitchella repens (×¾).

repens, Linn. PARTRIDGE-BERRY. SQUAW-BERRY. Fig. 1412. Lvs. opposite, round-ovate, petioled, with minute stipules: fls. in pairs, on the apex of a peduncle. Nova Scotia to Minn., south to Fla. and Tex. G. W. F. 42. D. 81. Mn. 3:49. L. B. C. 10:979.—Attractive in half-shaded spots in the wild garden and rockeries. Propagated by division of roots.

M. ovàta, DC., from Ecuador, is the only other species. It has solitary, sessile fls., and ovate, acutish lvs. Not cult.

M. B. COULSTON.

MITÉLLA (diminutive of *mitra*, a cap; applied to the form of the young pod). *Saxifragàceæ*. MITREWORT. BISHOP'S-CAP. Six or 7 species of low, slender perennials, with somewhat creeping rootstocks and racemes of small and greenish or white fls. Closely related to Tiarella, but the petals of the latter are entire, while in Mitella they are beautifully pinnatifid. Lvs. round, heart-shaped, alternate, except in one species, on rootstock or runners, with slender petioles; those on flowering stems opposite, if any; calyx short, 5-lobed, the lobes valvate in the bud, spreading; petals 5, inserted on throat of calyx, very slender; stamens 10 or 5, very short; fr. soon widely dehiscent. Natives of N. Amer., 2 species in E. Asia. —Offered by some dealers in native plants.

1413. Mitella nuda. Nearly natural size.

A. *Scapes usually leafless.*

B. *Fls. numerous.*

trifida, Graham. Lvs. round-reniform or cordate, crenately toothed and sometimes incised or lobed, 1–3 in. across; scape 9–12 in. long; fls. somewhat scattered on one side of spike; petals 3–5-parted, small; stamens 5, opposite the calyx lobes. N. Calif. to Brit. Col. and Rocky Mts.

BB. *Fls. few (about 5).*

nùda, Linn. Fig. 1413. Lvs. rounded or kidney-shaped, deeply and doubly crenate; raceme 4–6 in. long. Does well in moist shady situations. May–July. Westward to Brit. Col. A. G. 13:518.

AA. *Scapes bearing leaves.*

B. *Lvs. on scape alternate.*

caulèscens, Nutt. Raceme loose: stamens alternate with the pinnatifid petals. Brit. Col. to Ore.

BB. *Lvs. on scape opposite.*

diphýlla, Linn. Lvs. acutely heart-shaped, somewhat 3–5-lobed, toothed: raceme 6–8 in. long. May. Eastern U. S. V. 12:189.—A good plant for the rockery. M. B. COULSTON.

MITREWORT. *Mitella.* **False Mitrewort** is *Tiarella.*

MITRIOSTÍGMA (Greek, *mitre-shaped stigma*: from the conspicuous stigma, which is club-shaped, the 2-cut summit suggesting a cap). *Rubiàceæ*. This includes the charming evergreen tender shrub known to the trade as *Gardenia citriodora*. It makes a low or medium-sized bush of compact and branching habit and bears a great profusion of fls. which resemble those of the orange in odor, size, color and general appearance. The fls. are white, salver-shaped, 5-lobed, tipped with pink in the bud, and borne in dense axillary clusters. This delightful plant is a favorite in the South, together with the Cape Jessamine, but is little known in northern conservatories. The genus contains 2 species. For distinctions from Gardenia and Randia, see *Gardenia*.

axillàre, Hochst. (*Gardènia citriodòra*, Hook.). Lvs. opposite, petiolate, elliptic-lanceolate, subacuminate, glabrous; stipules awl-shaped from a broad base; calyx not ribbed, lobes lanceolate, acuminate, equal; corolla tube twice as long as the calyx, lobes obovate, obtuse. S. Afr. B.M. 4987. R.H. 1859, p. 175; 1886:348 (excellent!). F.S. 12:1254. W. M.

M'MAHON. See p. 963.

MOCCASIN FLOWER. North American name for species of *Cypripedium*.

MOCK ORANGE. See *Philadelphus*.

MÒHRIA (from Daniel Mohr, a German botanist; died 1808). *Schizàceæ*. A genus of South African ferns, having the habit of Cheilanthes, but the sporangia of the Schizæaceæ. A single species, *M. caffròrum*, is rare in cultivation in America. L. M. UNDERWOOD.

MOLE PLANT. *Euphorbia Lathyris* (see Fig. 800, p. 564).

MOLÍNIA (J. Molina, a writer upon Chilean plants). *Gramìneæ*. A genus of perennial grasses allied to Eragrostis, containing a single species. Native of central Europe and temperate Asia, and sparingly introduced in the United States. Panicle contracted: spikelets 2–4-fld., more or less purplish: glumes somewhat unequal: fl.-glume 3-nerved, rounded on back, pointed but awnless.

cærùlea, Moench (*Aira cærùlea*, Linn.). Culms tufted, 1–3 ft. high: lvs. rather rigid, slender pointed. The usual form in cult. is var. **variegàta**, with striped lvs., used for bedding. A. S. HITCHCOCK.

MOLUCCA BALM. *Moluccella lævis.*

MOLUCCÉLLA (diminutive made from Molucca). Also written *Molluccella*. *Labiàtæ*. This includes the Shell Flower, a quaint old annual plant, that self-sows

1414. Moluccella lævis (×⅓).

in old-fashioned gardens, but is now rarely advertised for sale. Its chief feature is its great cup-shaped calyx an inch long, which is much larger than the inconspicuous corolla (See Fig. 1414.) Later four white seeds or

nutlets appear in the cup or shell-like calyx, and add to the interest. The corollas are gaping, the upper lip forming a sort of hood, which may be notched or not, the lower lip 3-cut, the side lobes being oblong and somewhat erect, the middle one larger, inversely heart-shaped and deeply notched. Of 25 described names only 2 now remain in this genus as good species. Bentham & Hooker place this genus near Lamium. Other genera of garden value in which the upper lip of the corolla is concave or vaulted and often villous within are Stachys, Leonurus and Phlomis. From these Moluccella is easily distinguished by its calyx. These plants are hardy annuals, flowering in midsummer. The fls. are white, tipped pink, scarcely, if at all, thrust out of the calyx, and borne in whorls of 6–10.

A. *Calyx not prickly.*

lævis, Linn. Shell Flower. Molucca Balm. Fig. 1414. Height 2–3 ft.: lvs. roundish, with coarse round teeth: calyx obscurely 5-angled. W. Asia. B.M. 1852. —Fls. odorous.

AA. *Calyx beset with long prickles.*

spinòsa, Linn. Height 6–8 ft.: lvs. ovate, deeply and sharply cut: calyx with 1 long spine above and 7 others below. S. Eu., Syria. B.R. 15:1244 (as *Chasmonia incisa*).—Annual or biennial, with brownish red square stems, bristling calyx and gaping corolla. Said to have been cult. in Eng. since 1596. W. M.

MOMÓRDICA (*mordeo*, to bite, since the seeds appear to have been bitten). *Cucurbitàceæ*. There are 25 species of Momordica, chiefly African, according to Cogniaux (DC. Monogr. Phaner. 3). They are annual or perennial tendril-climbing herbs of tropical countries, some of which are cult. for ornament and also for the edible fruits. The fls. are monœcious or diœcious, the staminate solitary or paniculed, the pistillate solitary. Corolla and calyx similar in sterile and fertile fls.: corolla segments 5, often extending nearly to the base, making a rotate or broadly campanulate flower; stamens usually 3, the short filaments free, one of the anthers 1-loculed and the others 2-loculed: style single and long, with 3 stigmas: fr. oblong or nearly spherical, small, often rough, usually many-seeded, sometimes splitting into 3 valves, but usually indehiscent: seeds usually flattened, often oddly marked or sculptured. Tendrils simple—in this distinguished from Luffa. Momordicas are known to American gardens as ornamental vines, but the fruits of *M. Charantia* are eaten by the American Chinese. They are tender annuals. They thrive where cucumbers and gourds will. *M. Elaterium* of the catalogues is Ecballium, which see.

A. *Bract about midway on the peduncle, entire: all peduncles bracted.*

Charántia, Linn. Balsam Pear. Running 10 ft. or more, the stem slightly pubescent and furrowed: lvs. roundish, dull green, pubescent beneath (at least on the ribs), 5–7 lobes with rounded sinuses, the lobes sharp-toothed and notched: fls. yellow, 1 in. across, both the sterile and fertile solitary: fr. yellowish, oblong, pointed, furrowed lengthwise and tuberculate, 6 or 7 in. long, at maturity splitting into 3 divisions and disclosing the bright scarlet arils of the white or brown carved seeds. Trop. Asia and Africa, and naturalized in W. Indies. B. M. 2455. A. G. 13:525. R. H. 1869, pp. 630–1.—The Chinese about the American cities grow this plant under the name of La-kwa, for the edible pulpy arils surrounding the seeds, and also for the edible fruit itself (which is prepared, usually by boiling, before it is ripe). The rind is sometimes dried and used in medicinal preparations (see Bailey, Bull. 67, Cornell Exp. Sta., with illustr.). The odd seeds cause it to be called the "Art Pumpkin" by some.

AA. *Bract of sterile peduncle near the top, toothed: peduncle of fertile flower bracted at base or not at all.*

Balsámina, Linn. Balsam Apple. Slenderer and more graceful, bright green throughout, glabrous, the foliage smaller and neater: lvs. cordate-orbicular in outline, 3 in. or less across, 3–5-lobed, with rounded sinuses, the lobes and the few notches or teeth acute: fls. solitary, nearly or quite 1 in. across, yellow, often with blackish center: fr. orange, 2–3 in. long, ovoid and more or less narrowed each way, smooth or tuberculate: seeds compressed, nearly smooth. Widely distributed in Africa and Asia, and natnralized in the W. Indies. G.C. 1848:271. R.H. 1857, p. 182.—A neat vine, growing 4–6 ft.

AAA. *Bract near the top of the sterile peduncle, entire.*

involucràta, E. Meyer. Much like *M. Balsamina*, but teeth of lvs. blunt, with a short mucro, fls. larger, bract much larger: fls. white or cream-white, often dotted with black: fr. sulfur-yellow, changing to scarlet, bursting, 2 in. long. S. Afr. R.H. 1865:350 (as *M. Balsamina*, var. *leucantha*). B.M. 6932.—A very slender and graceful climber, with the peduncle bract against the calyx, like an involucre. Int. to Amer. trade about 1890.

M. Cochinchinènsis, Spreng. (M. mixta, Roxbg.), is a large species with 3-lobed lvs., pale yellow, purple-eyed fls., 4 in. across, and an oblong, bright red fr. 4–7 in. long. Farther India. B.M. 5145. F.S. 14:1478. G.C. III. 16:531. G.M. 37:777.

L. H. B.

MONÁRDA (after Nicolas Monardes, a Spaniard, who published in 1571 a book containing the earliest picture of an American plant. See Fig. 1077). *Labiàtæ*. Horse-Mint. This includes the Oswego Tea (*M. didyma*), one of the most brilliant of our native wild flowers, being surpassed in the intensity of its red only by the cardinal flower. It is a rather coarse herb, with large heads of gaping, wide-mouthed fls., which have none of the refinement of our cardinal flower. For mass effects,

1415. Monarda didyma ($\times \frac{1}{3}$).

however, these plants are very striking. They grow wild along the banks of streams, lighting up the dark corners of the woods. This suggests their proper place in landscape gardening. They should be grown in masses, in wild spots against a dark background. However, they can, if desired, be grown in an ordinary sunny border without more moisture than usual. As a bedding plant they would be inferior to *Salvia coccinea*, the flowers being shorter-lived. The white- and rose-colored varieties are less desirable. *M. fistulosa* is the same type of plant, and is procurable in colors ranging from white, flesh color and lilac, through rose and crimson to deep purple, but not scarlet. This species is very variable in height. The lighter colored varieties are usually less robust.

Monardas are easy of culture, thriving in any good soil. They spread quickly, and therefore need frequent separation, which operation is best done in the spring, as plants disturbed in the fall will often winter-kill.

Monarda is a genus of 9 species of aromatic American herbs: lvs. usually dentate: fls. often borne in dense heads, surrounded by an involucre of colored bracts; calyx tubular, 15-nerved, with 5 nearly equal teeth; co-

rolla narrow or dilated at the throat, 2-lipped, middle lobe of the lower lip larger than the lateral; perfect stamens 2. There are 2 sections of the genus, the species here described belonging to Eumonarda, in which the heads are generally solitary and terminal, the stamens and style conspicuously thrust out, and the root perennial. The following grow 1½–2½ ft. high. One of the common Horse-Mints is *M. punctata* (A.G. 14:15), but it is not in the trade.

A. *Calyx slightly hairy at the throat.*

didyma, Linn. (*M. Kalmiàna*, Pursh). Oswego Tea. Bee-Balm. Fragrant Balm. Fig. 1415. Stem acutely 4-angled: lvs. thin, ovate-lanceolate, acuminate. B.M. 145 (erroneously as *M. fistulosa*, var.), and 546. Vars. **álba** and **rósea**, Hort., are offered, but the latter should be compared with the next species. In 1893 John Saul advertised *M. Kalmiana* as if horticulturally distinct, calling it the finest of Monardas.—Suited to moister positions than the others.

AA. *Calyx densely bearded at the throat.*

B. *Lvs. petioled.*

fistulósa, Linn. Wild Bergamot. Sometimes called Bergamot in nursery catalogues, but the Bergamot of the Old World is *Mentha odorata*. Stem mostly obtusely angled: lvs. firmer: fls. purple. July, later than *M. didyma*. Var. **rùbra**, Gray. Fls. crimson or rosy red. Var. **mèdia**, Gray (var. *purpùrea*, Hort.). Fls. deep purple. S.B.F.G. 98. L.B.C. 14:1396 (as *M. purpurea*). Var. **móllis**, Benth. (*M. móllis*, Linn.). Fls. flesh-color to lilac. B.M. 2958 (as *M. menthæfolia*).—Will grow in dry positions.

BB. *Lvs. nearly sessile, at least below.*

Bradburiàna, Beck. Fls. light purple, spotted darker on the middle lobe of the lower lip, which is much larger than the lateral ones. June. Ill. to Tenn. and Kans. B.M. 3310 (erroneously as *M. fistulosa*).—A dryish position suits it best.

F. W. Barclay and W. M.

MONARDÉLLA (diminutive of Monarda, having its aspect, inflorescence and calyx). *Labiàtæ*. Annual or perennial sweet-smelling herbs, natives of California. Lvs. entire or obscurely toothed: fls. white, rose-color or purple, compacted in terminal heads with an involucre: calyx tubular, narrow or long, 10–13-nerved, 5-toothed; the teeth short, straight and nearly equal; the throat naked within; stamens 4, exserted. The following have been advertised, and can be secured through western collectors.

A. *Fls. large, comparatively few, loosely glomerate.*

macrántha, Gray. Perennial, tufted, about 9 in. high: bracts of the 10–20-fld. head sometimes whitish or purplish tinged: corolla about 1½ in. long, glabrous, orange-red, its tube fully twice the length of the calyx; the lobes lanceolate.

Var. **nàna**, Gray (*M. nàna*, Gray). Pubescent: bracts whitish or rose-color: fls. smaller; corolla not twice the length of calyx, white or tinged with rose-color, the slender tube pubescent.

AA. *Fls. smaller, more numerous, densely capitate.*

B. *Plants perennial.*

C. *Veins of lvs. numerous and prominent.*

villósa, Benth. Bracts ovate, leafy, pinnately veined.

CC. *Veins of lvs. not prominent.*

odoratíssima, Benth. Bracts thin, membranous, whitish or pinkish, inclined to parallel venation.

BB. *Plants annual.*

lanceolàta, Gray. Lvs. lanceolate or oblong, 1–2 in. long, tapering below into slender petioles, the margins even and entire: bracts leafy, ovate or oblong, mostly acute, abundantly veined between the ribs or primary veins by cross veinlets.

M. B. Coulston.

MONÉLLA. A section of *Cyrtanthus*.

MONÈSES (Greek, *single delight*; from the pretty solitary flower). *Ericàceæ*. One-flowered Pyrola. A genus of one species, a low perennial herb: stem decumbent: lvs. roundish, clustered at base: fls. single, drooping, from top of slender scape 2–6 in. long, white or rose-colored, 6 lines across; petals 5, widely-spreading, orbicular; filaments awl-shaped, naked; anthers as in Pyrola, but conspicuously 2-horned. **M. grandiflòra**, S. F. Gray (*M. uniflòra*, A. Gray), grows in moist woodlands from Labrador to Alaska, in middle states and westward along the mountains. It has been offered by one dealer in native plants.

MONEYWORT, or Creeping Charlie, is *Lysimachia Nummularia*.

MONKEY FLOWER. See *Mimulus luteus*.

MONKEY PUZZLE. *Araucaria imbricata*.

MONKSHOOD. *Aconitum*.

MONOGRÁMMA (Greek, a *single line*; alluding to the elongated linear sorus). *Polypodiàceæ*. A tropical genus of several small species of grass-like ferns, rarely seen in cultivation.

L. M. Underwood.

MONOLÈNA (Greek words referring to the single spur-like appendage on the anterior side of the anther-connective). *Melastomàceæ*. About 4 species of stemless herbs from Colombia, one of which is a small hot-house foliage plant, cult. like Bertolonia, and known to the trade as *Bertolonia primulæflora*. It has metallic green lvs. 4–6 in. long, with 3–5 parallel veins, the under surface of the lvs. a showy rosy purple. All the species have a characteristic rootstock, composed of clusters of short, thick rhizomes, prominently scarred by the falling of the lvs., and the fls. are numerous, and resemble a primrose. They are about 1 in. across, 5-petaled, pink, and borne on fleshy scapes. See *Bertolonia*.

primulæflòra, Hook. f. (*Bertolònia primulæflòra*, Hort.). Glabrous: lvs. leathery, broadly elliptical: calyx lobes broadly ovate-rounded. B.M. 5818. F.S. 18, p. 162. G.C. 1870:309, figs. 53, 54.

MONOLÒPIA (Greek, *one garment*; referring to involucre, the scales of which are united at base or into a cup). *Compósitæ*. Four species of yellow-fld., woolly annuals from California, with 8–10 pistillate rays which are 2–4-toothed or lobed. Lvs. entire or pinnately parted: peduncles terminal, solitary, 1-fld.: heads terminal, many-fld.: some of the disk rays sterile. Differs from Helenium in having no pappus.

màjor, DC. (*Helènium Douglasi*, Hort.). Small and woolly in the wild, green, and 2–3 ft. high in cult.: lvs. entire or somewhat toothed, sessile, linear to broadly lanceolate: fls. 2 in. across, yellow: rays dilated, coarsely 3–4-toothed, appendaged at the base. B.M. 3839. Still advertised in American catalogues under its synonym. Said to bloom most of the summer. Lvs. 3–5 in. long, reflexed; rays 8–9, fertile, short, broad and coarsely toothed, bright, golden yellow.

MONOPÀNAX. Referred to *Oreopanax*.

MONSTÈRA (Latin, *a monster*). *Aràceæ*. *Monstera deliciosa* is indeed a delicious monster in more senses than one. It is a favorite greenhouse climber, with huge perforated leaves, whose general appearance is sure to be remembered after the first look. (See Figs. 1416, 1417.) As the plant climbs, the stems emit long, aërial roots, many of which never reach the ground, but suggest the fingers of some fabulous monster. This grotesque, dragon-like aspect is very pronounced in a notable specimen in Philadelphia which has climbed into an upper gallery of the highest house in Horticultural Hall, Fairmount Park. Finally, this unique plant bears an edible fruit, which has a taste between a pineapple and a

1416. Leaf of Monstera deliciosa. Grown under glass in the North.

banana. The fruit grows about 6–8 in. long, and looks like a long pine cone, the rind being composed of hexagonal plates, as shown in Fig. 1417. The Monstera is a satisfactory greenhouse subject, even in a young stage, and being a great curiosity, excites much comment from visitors. It is generally kept in a hothouse, but succeeds in a coolhouse also. It is commonly allowed to grow in a spreading rather than climbing fashion; a noble

1417. Monstera deliciosa, climbing on a tree.

specimen of this kind cultivated in Pittsburg is figured by Wm. Falconer in A.F. 7:253.

As a conservatory plant it does best when planted out in a bed of rich soil, where it can be kept within bounds by judicious pruning. It is not particular as to soil, as it fills the pots in which it is planted with thick, succulent roots in a very short time. It is one of the best plants for enduring the varying conditions of temperature in a dwelling house, as nothing short of a freeze seems to hurt it. Propagated by division of the stem, with part of the leaf attached while rooting.

In the American tropics *Monstera deliciosa* requires a very warm, moist climate for the production of fruit. Although it naturally grows by attaching itself to trees and creeping up, it appears to be more fruitful if compelled to grow on the ground without climbing. The fruit is green in color until it ripens, when there is just a tinge of yellow, and the outer rind comes off in bits at a touch.

Monstera acuminata is the correct name of the astonishing plant known to the trade as *Marcgravia paradoxa*. The adult lvs. are something like those of *M. deliciosa*, being now and then perforated, but generally pinnately cut. The young lvs. are utterly different, being much smaller, entire and heart-shaped. This is one of the most striking cases of dimorphism celebrated in horticultural annals, though that of *Ficus repens* is more familiar, and similar ones occur in Philodendron. In its young stage *M. acuminata* is a very handsome hothouse climber, with thick, roundish, waxy lvs., which grow in two ranks and overlap one another. When the plant was introduced by Bull, it was shown growing on a board apparently in parasitic fashion, and emitting aërial roots. It seemed most like a Marcgravia, but when it flowered and fruited the first name was found to be one of the wildest possible guesses. Marcgravia is a dicotyledon and Monstera a monocotyledon, and the two genera are as far apart as is a Camellia from a Jack-in-the-pulpit. The Monstera-like lvs. are likely to be developed when the plant reaches 15 ft. In the young stage the plant is generally allowed to clamber over a dead log or tree-fern trunk, in the manner of Philodendron, which see for culture. Monstera is a genus of 13 tropical American climbers, with lvs. more or less densely 2-ranked. Engler in DC. Mon. Phan. Vol. 2. (1879).

deliciòsa, Liebm. CERIMAN. Figs. 1416, 1417. Young lvs, 1–2 ft. long, leathery, pinnately cut, perforated. A.F. 7:253. G.M. 41:329. Gn. 21, p. 39 (poor).

acuminàta, C. Koch (*M. ténuis*, C. Koch. *Marcgràvia paradóxa*, Bull). SHINGLE PLANT. Young lvs. a few in. long, waxy, entire. Gn. 29, p. 290 (both kinds of lvs.). G.C. II. 8:13.

WM. FAWCETT, G. W. OLIVER and W. M.

MONTANA, HORTICULTURE OF. Fig. 1418. Montana, from all standpoints, is nothing if not unique. The third largest state in the Union (Texas and California being first and second respectively), there is added to the natural capacity for great local variation found in a state covering 145,310 square miles, the additional feature of its being traversed by the main range of the Rockies. The eastern portion of the state is plains country, with a mean average altitude of 2,800 feet above sea level.

Along the southern boundary, perhaps 125 miles west of the state line, are the Wolf mountains, west of these the Rosebud and the Pryor mountains, toward the northern boundary and 175 miles west of the state line are the Little Rockies, west of these the Bear Paws, while dotted over the eastern central portion of the state are the Moccasins, the Big and Little Snowies, the Belts, the Highwoods and the Crazies. These, with the exception of the Belts, are isolated from other mountains, or detached spurs from the main range, and abound in the exceptional advantages which arise from good soil, favorable exposure and convenient means for irrigation.

About the center of the southern state line the main range of the Rockies is encountered. This range traverses the state from this point in a northwesterly direction, and after entering this range and proceeding westward one is never out of sight of mountains until reaching the western confines of the state.

The summits of the main range vary from 7,500 to 10,000 feet above sea level, and present mighty barriers to the winter storms which sweep madly over the country to the east and south of Montana, often bringing intensely cold weather in their wake. Then, too, the climate of the state is sensibly affected by chinooks, those much misunderstood currents of warm air which rob winter of all its terrors in regions visited by them. The botanist and horticulturist have much to learn, as yet, concerning the effect of altitude upon plant growth. In a general way, it is supposed that 9,000 feet is the so-called limit of timber, though, as a matter of fact, it often happens that above this point the crowns of the mountains are composed of living rock devoid of soil and other needed adjuncts to tree growth. Illustrations of the unwillingness of plant growth to be circumscribed by altitudinal lines are found in the city of Denver, which lies 5,000 feet above sea level. There many trees have been successfully transplanted from their natural habitat at sea level along the shores of Puget Sound to a point nearly a mile aloft, and into a climate as naturally dissimilar as could well be found. In Cheyenne, Wyo., there is a luxuriant development of the black locust at an elevation of 6,100 feet. This is a tree that needs to be most carefully handled to avoid winter-killing in Minnesota, 5,500 feet nearer to sea level. Another point in instance is found in the sugar beet chart of the Department of Agriculture. This is designed to show the belt of country in the United States best adapted to

beet-culture. This starts on the Atlantic in the latitude of New York city, extends nearly due westward to the western line of Wisconsin, and no drunkard ever pursued a more erratic course than it in making its way from the Great Lakes to the Pacific at the head of the Gulf of California.

Horticulturally speaking, Montana covers the entire scale of the limits of fruit production in the United States, except the citrous and other subtropical fruits. In no other state of the Union is there more need of the scientific experimenter, not so much to determine the species adapted to Montana as to wisely select the varieties of species that will give best results. There is one safe rule to observe in western fruit-tree planting,—avoid alkali soil. After an active experience of 15 years of tree-growing in Minnesota and the Dakotas, the writer is convinced that more failures in orcharding resulted there from planting in alkali soil than from any other cause. It is easy, however, to determine such conditions; very much easier under irrigation, as the application of water brings the salts to the surface, where they are easily noted, as they rapidly crystallize when exposed to the air. Within the valleys and cañons leading out from the mountains it is rare that alkali is found on suitable orchard locations.

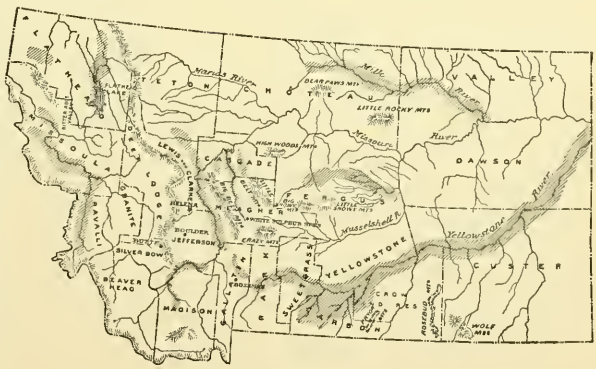
Montana owes much of its phenomenal success in fruit culture to natural conditions; most important of these is the abundant supply of water, easily available for irrigation. Irrigation in orcharding places the tree or plant under complete control. In the growing season, water can be supplied to supplement any existing lack of moisture, and by withholding this artificial aid in the latter part of the season, perfect ripening of the wood is accomplished and the tree placed in the best physical condition to endure sudden climatic changes. Again, it is customary to flood the orchard late in the season, after the foliage has fallen, with the result that root killing is absolutely unknown in Montana. So free is the state from disasters of this nature that budded trees are succeeding remarkably well wherever they have been set in close proximity to the mountains. Another decided advantage is in the physical formation of the state; the make-up of the mountains is not, as many suppose, a shaping up of every range and peak to a sharp rocky apex, but in all ranges there are vast expanses of open plateaus extending back onto lower outlying spurs. Heading in the mountains, usually near the summits, are deep cañons leading down and out to the open plains country at the foot of the ranges. There is a constant movement of air from the upper to the lower plateaus through these cañons occasioned by the superheating of the air of the lower levels during the middle of the day. The heat, in rising, causes a partial vacuum, and the cooler air of the upper levels flows down to occupy this. This is especially true in the earlier night hours. So common is this as to give the name "cañon breezes" to these currents, which are plainly to be felt miles away from every extensive cañon's mouth far out on the open plains. This constant current of air, passing over the surface of the earth, wards off frosts and gives fruit immunity from this great cause of loss to those growing fruit outside of mountain districts.

Early orcharding was attended with almost prohibitive conditions. In 1864, trees were set in Missouri valley by John G. Pickering, who is still living and planting. Some of the trees originally set are alive and bearing. Trees then came in by way of Utah on pack horses, and were sold for from $2.50 to $5 each. The next plantings were made near the present site of Stevensville, in the Bitter Root valley, by Bass Bros. Their apple crop for 1898 was estimated at 10,000 boxes. The Bitter Root valley is in the southwestern part of Montana, and is about 100 miles in length, with an average width of perhaps 10 miles. This valley has been the scene of the greatest activity in orcharding to date. It has an altitude of about 3,200 feet, and as it lies to the westward of the main range of the Rockies, it possesses marked advantages over the country to the eastward. It also has a soil exactly adapted to apples, pears, cherries, plums, grapes and small fruits. The soil is of decomposed granite, with an almost total absence of alkali. To the casual observer it appears to be light, stony, gravelly and comparatively worthless, but quite the reverse is the case. The main difficulty is to restrain undue growth of tree and superabundant fruitage. It is a soil that does not bake after irrigation, hence water can be freely used, and in a way stored, as evaporation does not occur from capillary attraction, as is always the case when there is too great a preponderance of clay in the texture of the soil. It is within bounds to state that upon soils carrying a heavy percentage of clay, fully one-half of the benefits arising from irrigation are lost from the inability of the farmer to cultivate immediately after irrigation. Bitter Root orchards range from 100 trees set for home use to 500-acre blocks for commercial purposes. The main difficulty there experienced is in the selection of the best varieties for general planting.

The pomologist can find in this one valley every variety of apple that is now growing in the combined nurseries of New York state. The only bars there found to the successful cultivation of all standard and small fruits is the brevity of the growing season and the coolness of summer nights; owing to altitude the air is rare and does not retain heat after sundown, as is the case in the lower-lying and more humid sections of the United States. The clearness of the atmosphere and attendant brilliancy of the sun gives to fruit such coloring as is never noted, except in similar altitudes; and while extended experiments have not been conducted along these lines, it is believed that the proper use of water in irrigation does not necessarily imply that the fruit thus grown carries an undue percentage of moistnre when compared with fruits grown without irrigation.

In the phenomenally dry season of 1894, Early Rose potatoes grown in Wisconsin were analyzed, as also were Montana Early Rose grown under irrigation, and the moisture content of the Wisconsin potatoes was considerably higher than that of the Montana potatoes.

What has been done in the valley of the Bitter Root



1418. Montana.
The shaded parts show horticultural areas.

is being attempted in Flathead valley, a large northwestern valley, with the best results. The range of varieties is fully as wide as that of the Bitter Root, and as the altitude is about 400 feet less it is to be expected that fully as good results will eventually be attained.

Some difficulty is experienced from frosts in the Flathead country, but as the heavy growth of deciduous and conifer timber, which covers the majority of the bench lands in this region, is cut off, no doubt the increased circulation of air will prevent serious loss to fruit from frost. Among other valleys achieving marked success in fruit and vegetable culture, are those of the Gallatin, Yellowstone, Upper and Lower Missouri, Clark's Fork of the Yellowstone, the Judith, Milk, Marias, Teton, Madison and Jefferson. In these valleys the better apples, cherries and plums are readily grown, and it is safe to say there are not 160 acres of farm lands in the state where, if the planter will avoid alkali soil and set trees with reference to the possibility of irrigating them, the Transeendant and Hyslop crabs, and the hardier of the standard apples, together with the small fruits, cannot be successfully grown. S. M. EMERY.

MONTBRÈTIA. See *Tritonia*.

MONTEREY CYPRESS. *Cupressus macrocarpa*.

MÓNTIA (Guiseppe Monti, professor of botany at Cologne in the first half of the eighteenth century). *Portulacàceæ*. About 18 species of American herbs, including the Winter Purslane, a salad or pot-herb known to the European trade as *Claytonia perfoliata*. This odd plant is perhaps cult. in America by a few fanciers of rarer kinds of vegetables. In hot countries it may be more desirable. It is an annual plant forming a compact tuft about 9–12 in. high. The lvs. are all from the root, tender, thick, fleshy, with a slender petiole about 2 in. long, and a blade about ½ in. long, which varies from lanceolate to rotund. The most remarkable feature is a sort of cup an inch or more in diameter, from which arise the racemes of small white fls. One of these cups crowns each of the stems, which are numerous, slender, leafless, and about twice as long as the lvs. The name "perfoliata" is suggested by the resemblance of the cup to a perfoliate leaf. In *M. perfoliata* the cup is usually 2-lobed, and the species runs into *M. parviflora*, which rarely has the cup transformed into two almost disjoined lvs. The Winter Purslane is now a weed in many parts of the world. The seed may be sown all through spring and summer where the plants are to stand.

Montia cannot be distinguished from Claytonia by any one character, but the cultivated plants of both genera have been sufficiently discriminated here and under Claytonia. The latest monograph is by B. L. Robinson in Syn. Flo. N. Amer., Vol. I, part 1, fasc. II (1897).

A. *Stems without true lvs.*

B. *Pedicels short, seldom exceeding the fruiting calyx.*

perfoliàta, Howell (*Claytònia perfoliàta*, Don). WINTER PURSLANE. Rather coarse, green, often reddening with age. Banks of streams, Calif. to Ariz. and Mex., north to Brit. Col.; common near Pacific coast. It grows wild in Cuba but is not native there, as often stated. B.M. 1336. R.H. 1897, p. 159.

BB. *Pedicels in fruit 2–6 lines long, much longer than the calyx.*

parviflòra, Howell (*Claytònia parviflòra*, Dougl.). More slender, green or slightly glaucous. Calif. to Brit. Col., east to Idaho and Utah.

AA. *Stems with numerous small alternate lvs.*

parvifòlia, Greene (*Claytònia parvifòlia*, Moc.). Fls. rose-color to white. Plant has bulblet-like offsets. Moist rocks, Brit. Col. to Rockies in Mont. and Alaska. This and the preceding one have been advertised, but have little if any ornamental value. W. M.

MOON DAISY. Name used in England for *Chrysanthemum Leucanthemum*.

MOONFLOWER in America always means *Ipomœa Bona-Nox* and related species; in England it rarely, if ever, means this, but *Chrysanthemum Leucanthemum* our common white weed or ox-eye daisy. Moonflower in England also means occasionally *Anemone nemorosa* and *Stellaria Holostea*.

MOONSEED. *Menispermum Canadense*.

MOONWORT. *Botrychium*; also *Lunaria*.

MOOSEWOOD. *Dirca palustris* and *Acer Pennsylvanicum*.

MORÆA (probably named after Robert More, botanist, Shrewsbury, England). *Iridàceæ*. Charming bulbous plants much like Irises, but unfortunately they are not so hardy as the common Irises and the individual fls. last only a day or so. Morœa is a genus of about 60 species, 45 of which are S. African, while the rest are chiefly from tropical Africa. Morœa is the African representative of Iris. No one character will separate the two genera. Morœas have no perianth tube, while Irises usually have one. The filaments are usually monadelphous in Morœa and free in Iris. Irises grow either from rhizomes or bulbs, while Morœas mostly grow from corms, except the subgenus Dietes, which grows from a rhizome. Most of the showiest Morœas belong to the subgenus known as Morœa proper. Species 7–13, described below, belong to this group. There is another subgenus which differs from it in having the ovary extended into a long beak which looks like a perianth tube, but none of this group is cult. The Morœas proper are about as tender as other Cape bulbs. The amateur may find some suggestions as to their culture under *Bulbs*, *Iris* and *Ixia*.

By far the largest and most remarkable plant of the genus is *Morœa Robinsoniana*. This grows 6–8 ft. high and has the habit of the New Zealand flax, *Phormium tenax*. A splendid specimen mentioned in B.M. 7212 bore 457 flowers between June 20 and Oct. 1. The individual fls. are 4 in. across, fragrant and last only a day. At Kew this noble plant has been successfully grown in the south end of a house. The stately plant pictured in G.F. 10:255 grew in a Californian garden and was said to be 16 years old from seed. The finest picture, however, is that in G.F. 4:355.

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glaucopis, 5.	Pavonia, 4.	villosa, 4.
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A. *Rootstock a short creeping rhizome.*
(*Subgenus Dietes*).
B. *Color of fls. chiefly white.*
C. *Height of plants 6–8 ft.* ..... 1. **Robinsoniana**
CC. *Height of plants 1–2 ft.* ..... 2. **iridioides**
BB. *Color of fls. chiefly yellow.* ..... 3. **bicolor**
AA. *Rootstock a tunicated corm.*
B. *Inner segments inconspicuous.*
(*Subgenus Vieusseuxia*).
C. *Color of fls. chiefly orange-red* ..... 4. **Pavonia**
CC. *Color of fls. chiefly white.*
D. *Spots blue* ..... 5. **glaucopis**
DD. *Spots brown* ..... 6. **tricuspis**
BB. *Inner segments conspicuous.*
C. *Height of stems 1–2 in.*
D. *Lvs. hairy all over* ..... 7. **papilionacea**
DD. *Lvs. hairy only at the edges.* 8. **fimbriata**
CC. *Height of stems more than 3 in.*
D. *Stems provided with 1 long wiry leaf, just below the inflorescence* ..... 9. **edulis**
DD. *Stems not so provided.*
E. *Fls. usually 1 or 2 on a stem* .....10. **spathacea**
EE. *Fls. loosely corymbose.*
fls. small.
F. *Spathes ½–¾ in. long* .....11. **juncea**
FF. *Spathes 1½ in. long* .....12. **tristis**
13. **polyanthos**

1. **Robinsoniàna,** Hook. (*Íris Robinsoniàna,* F. Muell.). WEDDING IRIS. Outer segments spotted red and yellow near base. B.M. 7212. G.F. 4:355; 10:255. J.H. III. 32:569. G.M. 34:569. G.C. 1872:393; III 9:457.

2. **iridioides,** Linn. Stem 1–2 ft. long, with many short, sheathing, lanceolate bracts: lvs. in fan-shaped basal rosettes: fls. over 3 in. across, white, marked yellow on claws of outer segments; style crests marked with blue. B.M. 693. L.B.C. 19:1861 (*Iris crassifolia*).

3. **bícolor,** Steud. Habit of *M. iridioides:* fls. 2 in. across, yellow, with beautiful brown spots on the outer segments; style crests yellow. B.R. 17:1404. L.B.C. 19:1886. P.M. 9:29 (all as *Iris bicolor*).

4. **Pavònia,** Ker. (*Íris Pavònia,* Linn. f.). Outer segments without a distinct claw, orange-red, with a blue-black or greenish black spot at the glabrous base. B.M. 1247.—Var. **villòsa,** Baker. Lvs. pilose: outer segments bright purple, with a blue-black spot on the hairy claw. B.M. 571 (*Iris villosa*). Var. **lutea.** Baker. Lvs. glabrous: fls. yellow, unspotted. B.M. 772 (*Morœa tricuspis,* var. *lutea*). In *M. Pavonia* and *glaucopis* the inner segments have a large central cusp and 2 lateral lobes, while in *M. tricuspis* the inner segments have 3 large cusps.

5. **glaucòpis,** Drap. Outer segments white, with a blue spot. B.M. 168 (erroneously as *Iris Pavonia*).—In this species the outer segments have a short, distinct claw, while *M. Pavonia* has none.

6. **tricúspis,** Ker. Outer segments whitish or lilac, with a purplish spot. B.M. 696.

7. **papilionàcea,** Ker. Fls. red or lilac, yellow on the claw; style crests erect. B.M. 750.

8. **fimbriàta,** Klatt. Fls. lilac. R.H. 1867:271.

9. **édulis,** Ker. Fls. lilac, spotted yellow. B.M. 613. —Var. **odòra** has white fls. Var. **longifòlia** has yellow fls. B.M. 1238.

10. **spathàcea,** Ker. Fls. yellow. B.M. 6174 (*Dietes Huttoni*).

11. **júncea,** Linn. Fls. lilac, in 2–3 clusters.

12. **tristis,** Ker. Lvs. 2–3, produced near the base, 1–2 ft. long: clusters of fls. 4–6: fls. dull lilac, ochre or salmon-colored, with a yellow spot. B.M. 577 (*Iris tristis*).

13. **polyánthos,** Thunb. Lvs. about 3, one from near the base of the stem, the others from the lower forks, ½–1 ft. long: clusters of fls. 5–20: fls. lilac.

M. Macleaii, advertised 1899 by Van Tubergen, is said to belong to the subgenus Dietes.—*M. Sisyrinchium*=Iris Sisyrinchium.

W. M.

MOREL. See *Mushroom.*

MORÍNA (Louis Morin, a French botanist, 1636–1715). *Dipsàceæ.* Seven or 8 species of perennial herbs in western and central Asia, from 3 in. to 4 ft. high. Lvs. opposite or whorled, narrowly oblong or linear, spinous-toothed: fls. whorled; whorls in spikes, surrounded by wide-based floral lvs.; bracteoles among the fls. few, spiny.

longifòlia, Wallich. A handsome plant 2 ft. high, with thistle-like foliage: lvs. 6 in. long, 1 in. across: fls. showy, deepening from white in the bud to pink and finally crimson, crowded in dense whorls near the top of stem. Hardy. Cult. in light, sandy soil, with partial shade. Prop. by seed and by division in early autumn. Useful in the rockery and border, and with other foliage plants. June–Aug. Himalayas. B.M. 4092. B.R. 26:36. R.H. 1857:514.—Whorl-flower is a catalogue name.

MORÍNDA (Latin, *morus,* mulberry, and *Indica,* Indian). *Rubiàceæ.* This includes the Indian Mulberry, *M. citrifolia,* a tropical fruit tree cult. in S. Fla. and S. Calif. (see Fig. 1419). It has heads of small white fls., followed by globose or ovoid, berry-like fruits about 1 in. long. The genus contains about 40 species of shrubs, trees and climbers in tropical Asia, Australia and the Pacific islands, and 3 or 4 tropical American species. Lvs. opposite, rarely in 3's: fls. white, in axillary or terminal, simple, paniceled or umbellate heads; corolla tube short or long; lobes 4–7, coriaceous, valvate in the bud.

citrifòlia, Linn. INDIAN MULBERRY. Fig. 1419. A small tree, with shining, broad or narrow, oval lvs. on very short petioles: stipules large, broadly oblong or semi-lunar; fl.-head on solitary peduncles 1 in. long usually in the axil of every other pair of lvs.: calyx limb truncate: corolla 5–7 lobed, tube about ½ in. long: fruits yellowish, fleshy, in a globose or ovoid head about 1 in. in diam. G.C. II. 11:333.

Var. **bracteàta,** Hook. Stipules more acute: calyx limb often with a lance- or trowel-shaped, white, leafy lobe, sometimes 3 in. long. Offered in S. Calif. and Fla.

M. B. COULSTON.

MORÍNGA (altered from the native Malabar name). *Moringàceæ.* Only three species comprise the family Moringaceæ, all members of the genus Moringa. They are small, spineless trees, with alternate, deciduous, pinnate lvs., axilary panicles of rather large, white or red fls., and long, pod-like fruits. They are native of N. Africa and the tropical parts of Asia. The position of the family Moringaceæ is difficult to determine. Bentham & Hooker ally it with Anacardiaceæ. Engler and Prantl place it between Resedaceæ and Sarraceniaceæ. Grisebach joins it to the Capparidaceæ. Others ally it

1419. Morinda citrifolia branch with leaves, flowers and fruit (×⅔). Also vertical section of fruit (fruit sometimes larger) and enlarged flower below.

with the Leguminosæ, which it resembles in external appearance. Fls. perfect, 5-merous; calyx cup-shaped, 5-cleft, the lobes reflexing; petals 5, one of them erect and larger; fertile stamens 5, alternating with 5 or 7

1420. Moringa oleifera
About natural size.

1421. Moringa oleifera—the Horse-radish Tree. (×⅓.)

staminodia, the anthers attached on the back, and 1-loculed: fr. a long, 4–9-angled, 1-loculed pod with 3 valves, the seeds immersed in the spongy contents of the valves.

oleífera, Lam. (*M. pterygospérma,* Gærtn.). Horse-radish Tree. Figs. 1420, 1421. Small tree (reaching 25 ft.), with soft wood and corky bark, the young parts pubescent: lvs. mostly 3-pinnate, 1–2 ft. long, all parts stalked: fls. whitish, stalked, fragrant, 1 in. across: pod often 1¼ ft. long, 9-ribbed, bearing 3-angled, winged seeds. India, but now spontaneous in parts of the W. Indies.—The Horse-radish Tree is so named from the pungent taste of the root, which is sometimes eaten. The young fr. is also edible. The seeds (called bennuts) yield an oil, which is more or less used in the arts. The tree is sometimes cult. in the extreme southern U. S.

L. H. B.

MORMÒDES (Greek, *a grotesque creature*). *Orchidàceæ.* This genus is remarkable for the interesting form of its flowers, which suggested the name given to the genus by Lindley. The plants are rather large, with long, tapering pseudobulbs sheathed by the dry bases of the fallen lvs.: lvs. long, plaited, deciduous in the autumn: raceme from the base of the pseudobulbs bearing many showy fls.: sepals and petals subequal, mostly narrow; labellum firmly united with the column, with revolute margins, rarely concave, turned to one side; column without appendages, twisted in the opposite direction from the labellum. Distinguished from the closely related genus Catasetum by its perfect fls. and wingless column.

Mormodes are commonly found in poor condition among the collections, which is the result of neglect rather than difficulty of cultivation. They should be grown in small baskets suspended from the roof, in a compost of equal parts of clean chopped peat-fiber, sphagnum and sod, interspersed by nodules of charcoal, and the whole pressed in firmly around the roots. The roots like to work among the charcoal, and this also serves the purpose of dividing the compost, thereby allowing it to dry out more readily. Mormodes do not require an abundance of water at any time, and the compost should frequently be allowed to dry out during the growing season. When at rest, an occasional application will suffice to keep the soil moist and the pseudobulbs from shriveling. Rebasketing should take place at the commencement of new growth in spring. They all require warmhouse temperature; the Cattleya or Cypripedium department affords them a proper location regarding temperature and moisture.

Cult. by Robert M. Grey.

Colóssus, Reichb. f. Pseudobulbs 6–12 in. long, clothed with brown sheaths: lvs. elliptic-ovate, 10–15 in. long, plaited: raceme inclined, 2 ft. long, with the stalk: fls. 5–6 in. across; sepals and petals narrow-lanceolate, spreading or reflexed, with recurved margins, pink below, changing to yellow toward the upper portion; labellum ovate, long-acuminate, very revolute, yellow, somewhat sprinkled with pink dots. March. Cent. Amer. B.M. 5840.—A plant of striking appearance.

pardìna, Batem. Pseudobulbs 4–7 in. high, stem-like, sheathed by the bases of the lanceolate, striate lvs., which are 4 times as long: raceme nodding, many-fld., shorter than the lvs.: fls. yellow, spotted with reddish purple, fragrant, crowded on the upper end of the stalk; sepals and petals ovate, pointed, convergent; labellum nearly like the segments but with 2 lateral acute lobes. July, Aug. Mex. B.M. 3900. F.C. 3:113.—A curious and rather rare plant. Var. **unicolor,** Hooker (*Marmòdes citrina,* Hort.). Fls. of one color, all yellow. B.M. 3879. I.H. 1:25. G.C. III. 14:181. Var. **aurantìaca,** Rolfe. Sepals and petals golden yellow; labellum yellow. I.H. 39:144.

Buccinàtor, Lindl. Plants 1–2 ft. high: lvs. lanceolate, membranous, striate: fls. pale green, with an ivory-white lip; sepals linear-oblong, the lateral ones reflexed; petals erect; labellum subrotund-cuneate, with the sides rolled back, giving it the appearance of a trumpet. April. Mex. B.M. 4455 (*M. lentiginosa*).—This plant is extremely variable in color, ranging from nearly white to chocolate-brown, the various forms being either spotted or plain. Its forms have been described under at least 7 distinct specific names.

luxàta, Lindl. Pseudobulbs 4–6 in. long: sheathing lvs. 1–2 ft. long, narrow-lanceolate, plaited: raceme much shorter: fls. 2 in. in diam., rather fleshy and globular, lemon-yellow, with a dark brown streak down the labellum; sepals ovate-lanceolate; petals oblong, concave; labellum hemispherical, concave, obsoletely 3-lobed. July. Mex. B. R. 29:33. R.H. 1889:132.—Very fragrant. The fls. are remarkably distorted. Var. **eburnea,** Hort. Fls. creamy white. This is a very effective plant, superior to the type. G.C. II. 18:145. I.H. 34:35.

1422. Staminate catkin of Russian Mulberry. Natural size.

1423. Pistillate catkin of Russian Mulberry. Natural size.

Heinrich Hasselbring.

MORNING-GLORY. *Ipomœa purpurea.*

MORRÈNIA (Professor Charles Morren, Belgian botanist). *Asclepiadàceæ.* One or two pubescent twining shrubs of S. Amer., allied to Cynanchum, but differing in its convex 2-lobed stigma (flat or concave in

Cynanchum) and the tubular corona, which is longer than the pistils, villose on the inside, and conniving over the pistils. The lvs. are opposite and hastate. **M. odorata**, Lindl., is offered by Franceschi, S. Calif. It has white fragrant fls. in dense cymes in the axils. De scribed by Lindley as long ago as 1838, but appears never to have been brought into cultivation. Franceschi says it is "a noble vine; foliage very distinct." Argentine and Paraguay.

1424. Staminate flower of Russian Mulberry. Enlarged.

1425. Pistillate flower of Russian Mulberry. Enlarged.

MŌRUS (the ancient Latin name). *Urticàceæ* or *Moràceæ*. MULBERRY. About 100 species of Mulberry have been described, but the latest monographer (Bureau, DC. Prodr. 17:237 [1873]) reduces them to 5. Some of the names are now referred to other genera. Many of the names represent cultural forms of *M. alba*. Mulberries are grown as food for silkworms and for the edible fruits. The silkworm Mulberry of history is *M. alba*, and the fruit-bearing Mulberry of history is *M. nigra*. Yet, strangely enough, the leading fruit-bearing varieties of North America are derived from *M. alba* (see Bailey, Bull. 41, Cornell Exp. Sta., and "Evolution of Our Native Fruits"). The native *M. rubra* has also given varieties which are grown for their fruits. The silkworm Mulberry of the Chinese is *M. multicaulis*, by some considered to be a form of *M. alba*. This was introduced into North America early in the century, and for a time there was the wildest speculation in the selling and planting of the Mulberry tree, and in the rearing of silkworms. These efforts have now largely passed away in North America. *M. multicaulis* gave rise to one variety which was prized for its fruits, the Downing. This variety is now little known, but the name has been popularly but erroneously transferred to a good variety of *M. alba* (the New American).

The Mulberries are trees of the temperate regions of the Old and New World. The genus Morus usually has monœcious flowers, both sexes being in small hanging axillary catkins, the males soon falling (Figs. 1422–23). The calyx is 4-parted: stamens 4, the filaments partially inclosed in the calyx-lobes (Fig. 1424). In the pistillate flower there is one ovary with 2 stigmas, and the 4 calyx-lobes are adherent to the ovary (Fig. 1425). The pistillate flowers become fleshy and cohere into a long multiple fruit which suggests a blackberry in external appearance (Fig. 1426).

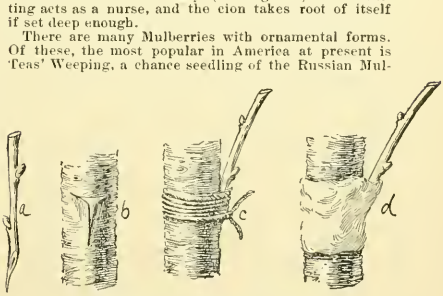
1426. Fruit of Morus alba. Natural size.

In North America the Mulberry is known chiefly as a fruit-bearing tree, although it is never planted extensively and the fruit is scarcely known in the market. Two or three trees about the home grounds are sufficient to supply a family. The fruits are sweet and soft. To many people they are too sweet. Because of their sweetness they are of little value for culinary uses. They usually drop when ripe. They are harvested by being shaken on sheets or straw. Birds are exceedingly fond of them. In the East and North, varieties of *M. alba* are chiefly grown, as the New American (Downing of most present nurseries), Thorburn and Trowbridge. On the Pacific coast and in some parts of the South, varieties of *M. nigra* are grown, particularly the Black Persian. In parts of the South forms of the native *M. rubra* are grown, as Hicks and Stubbs. These are popular for planting in hog pastures, as the animals like the fruits. The Mulberry thrives in any garden soil. It does well even on thin gravels and rocky slopes. For fruit-bearing purposes, trees may be planted from 20 to 40 feet apart.

The Russian Mulberries are offshoots of *M. alba*. Their particular merits are great hardiness to withstand cold, drought and neglect. They are useful for low wind-breaks and also for sheared hedges. They have become popular on the plains. They are readily propagated by seeds, and the resulting plants are variable. Now and then a large-fruited form appears and it may be named and propagated, but for the most part the Russian Mulberry has little merit for its fruits unless one desires to feed the birds.

Varieties of Mulberries are now mostly worked on seedlings of the Russian. One of the most successful grafts is S. D. Willard's method, shown in Fig. 1427. The grafting is performed in spring when the bark will slip, using cions which have been kept perfectly dormant or on ice. *a* is the cion, the lower part being cut thin so that it will enter readily between the bark and wood of the stock. *b* is the stock, with an incision made through the bark essentially as for shield-budding. *c* shows the graft bound with raffia. *d* shows the completed operation, the work being covered with grafting wax. *Morus multicaulis* grows from cuttings in the South. These cuttings, with the buds removed to prevent sprouting, are often grafted before they are planted with a long cion of the desired variety (see Fig. 941). The cutting acts as a nurse, and the cion takes root of itself if set deep enough.

There are many Mulberries with ornamental forms. Of these, the most popular in America at present is 'Teas' Weeping, a chance seedling of the Russian Mul-



1427. A method of grafting the Mulberry. *a*, the cion; *b*, matrix to receive cion; *c*, the graft tied; *d*, the graft waxed.

berry tribe. When grafted several feet high on straight Russian stock, it makes one of the best of small weeping lawn trees (Fig. 1428). It originated on the grounds of John C. Teas, Carthage, Mo., about 1883. Various cut-leaved forms, mostly of *M. alba*, are seen in fine collections, of which the form known as *M. nervosa* (Fig. 1429) is one of the best. The foliage of Mulberries is interesting because so variable. Even on the same tree there may be leaves of several forms, while different trees of the same species may show strong individual traits. The most striking variations are in the lobing of the leaves.

A. *Lvs. mostly bright and glabrous above, and usually glossy.*

B. *Style very short or practically none.*

álba, Linn. WHITE MULBERRY. Figs. 1430, 1432 B. Lvs. light green, rather small, smooth or very nearly so above and often shining, the veins prominent beneath and whitish, variously lobed or divided, the basal lobes unequal, the teeth large and for the most part rounded or nearly obtuse, the branches gray or grayish yellow: fr. variable, usually narrow, 1–2 in. long, white or violet, very sweet. China.—*Morus alba* has been cultivated from the earliest times, chiefly for feeding the silk worm. It is a frequent tree along roadsides and in the old yards in the eastern states, where the trunk sometimes attains a diameter of two feet. This half-wild form usually has rather small rounded shining leaves with very large rounded teeth, and bears little whitish or violet fruits, which are very sweet. Sometimes the

fruits are an inch long, but they are oftener only half that length, and one sometimes finds trees on which the fruits are barely a quarter of an inch in length. Now and then a tree bears fruit nearly or quite black. Birds, poultry and hogs are fond of these Mulberries. The trees are usually very thick-topped and bushy growers, but occasionally one is seen which, when young, has branches as straight and trim as a Northern Spy apple. These half-wild trees are seedlings, and this accounts for their variability.

1428. Teas' Weeping Mulberry.

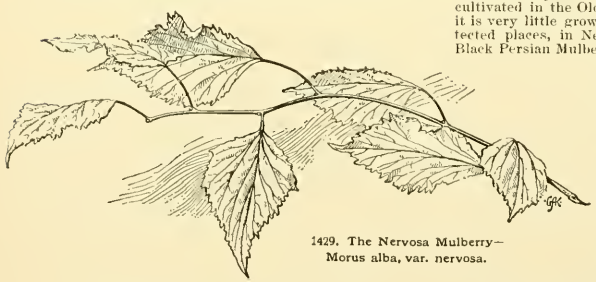
Var. **Tatárica**, Loudon (*M. Tatárica*, Linn.). RUSSIAN MULBERRY. Figs. 1422–25, 1431. A hardy type of *Morus alba* which was introduced into our western states during 1875–77 by the Russian Mennonites. It differs little from the type of *Morus alba* in botanical characters. As commonly seen, it is a low-growing very bushy-topped, small tree with small and much-lobed lvs. The fruit is usually very small and insipid, and varies from creamy white to violet, deep red and almost black.

Var. **nervósa**, Hort. Fig. 1429. Lvs. contracted and jagged, and very strongly marked with many white veins. It bears fruit a half-inch long. Among the horticultural curiosities this tree should find a place, although it is not grown by our nurserymen. Its ornamental value is considerable, especially when striking effects are desired. Rare in America. A large specimen stands in the grounds of the Department of Agriculture at Washington. The history of the Nervosa Mulberry is obscure. Delile described it in a French periodical as long ago as 1826, and it is described in monographic works. It is of horticultural origin.

The following names, which one may find in horticultural literature, are referable to *M. alba: cedrònа(?), colombássa, Constantinopolitàna, globòsa, intermèdia, Hálica, laciniàta* (of some), *lùcida, membranàcea, macrophýlla, Morélli, Romàna, rósea, urticæfòlia.*

BB. *Style evident or even prominent.*

Japónica, Audib. (*M. álba*, var. *stylòsa*, Bureau). Lvs. usually large, dull, rather thin, long-pointed, the rounded teeth very large and deep, or the margin even almost jagged, the leaves upon the young growth usually deeply lobed. China, Korea, Japan.—This species has been introduced lately. It is tender in the North when young. The fruit is described as short-oblong and red.



1429. The Nervosa Mulberry—Morus alba, var. nervosa.

AA. *Lvs. dull green, mostly rough or pubescent.*

B. *Full-grown lvs. more than 4 in. long.*

multicaùlis, Perr. (*M. álba*, var. *multicaùlis*, Loudon. *M. alba*, var. *latifòlia*, Bureau. *M. Sinénsis*, Hort. *M. latifòlia*, Poir., which Bureau refers here, is probably *M. Indica*, Linn.). Fig. 1432 A. A strong-growing small tree or giant shrub, with dull, roughish and very large, long-pointed lvs., which are seldom or never prominently lobed, and which are often convex above, bearing black, sweet fr.; style evident. China, where it is the chief silkworm Mulberry.—Once much grown in this country, but not now well known, particularly not in the North.

1430. Morus alba ($\times \frac{1}{4}$).

nigra, Linn. BLACK MULBERRY. Lvs. dark, dull green, rather large, tapering into a prominent point, commonly very rough above, usually not lobed, the base equal or very nearly so on both sides, the teeth rather small and close, the branches brown: fr. large, comparatively thick and fleshy, mostly dark-colored. The black Mulberry is a native of Asia, probably of Persia and adjacent regions.—This is the species which is cultivated in the Old World for its fruit. In America it is very little grown. It is not hardy, except in protected places, in New England and New York. The Black Persian Mulberry of the South and of California is probably of this species.

rùbra, Linn. NATIVE RED MULBERRY. Fig. 1433. Lvs. usually large, very various, those on the young shoots deeply lobed with very oblique and rounded sinsues, in the base of which there are no teeth, the upper surface rough and the lower one soft or variously pubescent, the teeth medium or comparatively small and either rounded or bluntish: fr. deep red, or when fully ripe almost black, variable in size, often very good, nearly always having an agreeable slight acidity. Mass. to Fla., Kans. and Tex., mostly in rich soils and bottom lands. S.S. 7:320.—This native Mulberry has been tried for the feeding of silkworms, but with indifferent success. At least three of the named fruit-bearing Mulberries belong to it, and a yellow-leaved Mulberry, which is

somewhat grown for ornament, also appears to be of this species. The curious lobing of the lvs. on the young growth is shown in the upper spray of Fig. 1433. The nearest approach to this lobing is in the Japanese (*Morus Japonica*), and this affords another of those interesting parallelisms which exist between the Japanese and eastern American floras. The red Mul-

1431. Russian Mulberry—Morus alba, var. Tatarica (×¼).

berry is the largest tree of the genus. In the South it often attains a height of 70 ft. and a diam. of 3 or 4 ft. The timber is used for posts and light woodwork.

Var. **tomentòsa**, Bureau (*M. tomentòsa*, Raf.). Lvs. very soft-pubescent and whitish beneath, often glossy but rough above. Tex.—A large-fruited form of this was introduced in 1889 by T. V. Munson as the Lampasas Mulberry.

BB. *Full-grown lvs. usually 3 in. or less long.*

celtidifòlia, HBK. (*M. Mexicàna*, Benth. *M. microphýlla*, Buckl.). Much smaller tree than *M. rubra*, rarely more than 25 ft. tall, and with smaller and smoother lvs. and smaller, sourer black fr., which ripens earlier and is not so good. Lvs. cordate-ovate, more or less lobed, mucronate-serrate, nearly smooth on both sides; fr. short-ovate or sometimes nearly globular. Tex. and Ariz. to Ecuador. S.S. 7:321.—Occasionally planted for its fruits. L. H. B.

MOSQUITO PLANT. See *Cynanchum*.

MOSS. A general name for many humble green plants of the cryptogamia (flowerless plants), mostly with distinct stems and foliage leaves. In North America there are about 1,200 species, distributed in numerous families and four orders. They have solitary, mostly stalked spore-cases or capsules arising from the apex of a leafy stem (Fig. 1434). The capsule is covered with a thin cap or calyptra (c) which is shed at maturity. The capsule opens by means of a lid or operculum (o), and the orifice is usually guarded by one or two rows of teeth or a peristome. None of the Mosses are horticultural plants, although Sphagnum Moss is much used as a packing material and for holding moisture about pots, and as a medium in which to sow delicate seeds. It is collected from bogs. Club Mosses are not true Mosses, but lycopodiums (which see). The "Moss" on fruit and other trees is mostly lichen. The Florida or Spanish Moss is a flowering plant (see *Tillandsia*). L.H.B

1432. Leaf of Morus alba at B; of M. multicaulis at A.

MOSS PINK. *Phlox subulata*

MOTHER OF THOUSANDS. *Linaria Cymbalaria*; also Hen-and-chickens daisy (Bellis), and *Saxifraga sarmentosa*.

MOULDS. The term Mould is generally applied to any small fungous growth which appears on decaying organic matter, such as fruits, both fresh and preserved, vegetables, etc. The Moulds are very simple fungi producing immense numbers of spores, a fact which accounts for their presence everywhere, in the air, in dust, and on all exposed bodies. As a rule these fungi are not directly injurious to plants; they are normally saprophytes and perform a great service in disorganizing organic matter which would otherwise accumulate on the earth. A few of the species may become parasitic. Thus, species of Botrytis often attack lettuce in forcing-houses which are too close and damp. Carnation buds and violet plants are also frequently injured by Botrytis. The mould-like growths occurring on boards in damp cellars or in greenhouse benches are sterile mycelia of higher fungi. These do not attack plants, but sometimes, as in the case of violets, grow over and smother the plants. (See also *Diseases, Fungi*. HEINRICH HASSELBRING.

MOUNTAIN ASH. *Pyrus Aucuparia*. **M. Cherry.** *Prunus angustifolia*. **M. Ebony.** *Bauhinia*. **M. Holly.** *Nemopanthes fasciculatus*. **M. Laurel.** *Kalmia*, particularly *K. latifolia*. **M. Mahoe.** *Hibiscus elatus*. **M. Mahogany.** *Cercocarpus*. **M. Mint.** *Pycnanthemum*. **M. Rose.** *Antigonon*.

1433. Morus rubra, the native Mulberry (×⅛).

MOURNING BRIDE. See *Scabiosa*.

MOVING PLANT. *Desmodium gyrans*.

MUCÙNA (Brazilian name). *Leguminòsæ*. Between 20 and 30 mostly twining plants, widely distributed in the tropics, one of which is somewhat cultivated as a forage plant. The genus is allied to Glycine, which includes the Soy Bean. The lvs. are large and 3-foliolate: fls. long or oblong, large, usually dark purple (sometimes yellowish) but turning black when dried, the corolla much longer than the narrow-lobed calyx; the keel long, boat-shaped and usually twice or thrice longer than the obtuse standard and also longer than the wings: stamens diadelphous (9 and 1) the anthers not uniform in kind: pod usually hairy, bristly or pubescent, containing globular pea-like seeds. The Mucunas are either annuals or perennials. The fls. are borne in axillary clusters, and the pods are usually long-and beset with stinging hairs.

1434. A true moss—Polytrichum commune. Nat. size. (See p. 1035.)

prùriens, DC. (*Dòlichos prùriens*, Linn. *D. multiflòrus*, Hort.). Cowitch. Cowage. Fig. 1435. Annual twiner, the branchlets somewhat appressed-hairy and the lvs. more or less silky-hairy beneath: petioles usually longer than the lvs.: lfts. ovate or the lateral ones rhombic-ovate, obtuse but apiculate: fls. several to many, dull purple, 1½–2 in. long, in more or less drooping racemes: pods f-shaped (the ends curved in opposite directions), 2–4 in. long, ribbed, densely brown-or gray-bristly.—Tall-twining vine, common in the tropics of both hemispheres. The hairs or bristles on the pods are dislodged by the touch and they are very irritating to the skin, often raising blisters. These hairs also constitute a remedy for intestinal worms, it being supposed that they kill the worms by irritating or stinging them. It is a variable species.

Var. **ùtilis** (*M. ùtilis*, Wall.). Velvet Bean. Banana Bean. A cultivated form, differing in the mostly shorter pods, which are only velvety (not bristly-hispid). Widely grown in the tropics.—Of late it has attracted attention in the Gulf states as a forage and green-manure crop, but its use is still in the experimental stage in most places. Cattle have been fed successfully on the meal made of the beans ground in the pod, but people have been made sick by eating the green cooked beans, and chickens have been killed by both raw and cooked beans. Because of its vigorous growth, the Velvet Bean promises well as a soil renovator, as the cow-pea does, although it can not be be grown so far north as that plant. It is a good ornamental plant, growing 10–20 ft. high when supplied with support. The handsome globular beans (⅝–½ in. diam.) have markings which suggest the castor bean.

capitàta, Sweet. Cult. in India and Japan (A. G. 13:728) as a household vegetable (as a shell bean), but doubtfully distinct from the above: fls. usually fewer on erect or ascending peduncles: pod mostly larger and flatter, less hairy and becoming nearly or quite glabrous at maturity: bean larger, somewhat flattened.—Not yet reported in this country.

nìvea, DC. Also cult. in India, and perhaps a cultural race of *M. prurìens*: fls. white: pod large, black, becoming glabrous. L. H. B.

MUEHLENBÉCKIA (after Dr. Muehlenbeck, a Swiss physician). *Polygonàceæ*. A rather small genus of climbing or erect, usually slightly shrubby plants, all inhabitants of the south temperate zone: lvs. alternate, with sheathing stipules at the base: fls. unisexual, small, fascicled in the leaf-axils; perianth with 5 nearly equal lobes; stamens 8: ovary 1-celled, 1-ovuled: styles 3: akene obtuse or acute, 3-angled, crustaceous, about equaling the succulent perianth. All greenhouse plants, very various in appearance.

compléxa, Meissn. A twining or drooping, somewhat shrubby plant: stem slender and much-branched, glabrous except when very young: lvs. very small, 3–5 lines long, light green, about equaling the petiole, mostly fiddle-shaped, rarely hastate; sheaths small, tubular, deciduous: fls. 1–6, in somewhat racemose, pubescent clusters, green and inconspicuous: fr. with a succulent, transparent, whitish, persistent perianth. New Zealand.—A graceful greenhouse basket plant, but may also be made to twine. Fruit clusters glistening, showy. Is sometimes called Polygonum by florists.

platycládos, Meissn. (*Coccóloba platycláda*, F.Muell.). A very interesting erect, shrubby plant, with broad, flat, ribbon-like, glossy, delicately striate branches, replacing the lvs., which are scanty or entirely wanting: lvs. membranous, oblong-lanceolate, sometimes hastate: bracts and stipules very short: fls. white, in few-fld. clusters: akenes included in the fleshy perianth, which at maturity is bright red or at length deep purple and quite showy. Solomon Isls. B.M. 5382.—Frequently grown in greenhouses because of the odd flat stems and showy fruit.

M. adprèssa, Meissn. Large, diffuse, bushy plant, with small pink fls. in paniculate spikes: lvs. up to 2 in. long broadly oblong, often cordate, glabrous. Australia. B.M. 3145 (as Polygonum). Cult. in Europe. K. M. Wiegand.

MUEHLENBÉRGIA (Dr. H. Mühlenberg, who wrote a work upon American grasses in 1817). *Gramíneæ*. About 60 species, mostly American. Spikelets 1-fld. The following is offered by one dealer in native plants.

glomeràta, Trin. An erect perennial, with rather short appressed lvs.: panicle contracted and spike-like: empty glumes nearly equal, 1-nerved, extending into short awns: fl.-glume longer than empty glumes, except the awns. Wet ground, nearly throughout northern U. S. A. S. Hitchcock.

MUGWORT. *Artemisia vulgaris*.

MUÍLLA (an inversion of Allium). *Liliàceæ*. A genus of one species, an unimportant plant advertised by one specialist in Pacific coast bulbs. It has a slender scape 3–12 in. high, bearing early in the year an umbel of 5–15 greenish white fls., each about ½ in. across. The genus is close to Allium, but instead of a true bulb it has a fibrous-coated corm, and also lacks the onion-like odor. Generic characters are: perianth subrotate, persistent, of 6 nearly equal, slightly united segments: filaments slightly thicker at the base: ovules 8–10 in a cell: style club-shaped, persistent and at length splitting.

maritima, Wats. Lvs. several, not sheathing at base, scabrous, as long as the scape. Calif., Nev.

MUKIA. See *Melothria*.

MULBERRY. Discussed under *Morus*. **French M.** *Callicarpa Americana*. **Indian M.** *Morinda*. **Paper M.** *Broussonetia*. The wild *Rubus odoratus* is improperly called Mulberry in some parts of the country.

MULCHING has four general objects: (1) to conserve moisture in the soil by preventing or hindering evaporation; (2) to protect plants from winter injury; (3) to keep the surface of the soil loose and friable; (4) to add plant-food to the soil.

The moisture which is available to agricultural plants is held in the soil by means of capillary attraction. The soil may be conceived to be full of irregular capillary tubes which have a general vertical direction. The upper ends of these tubes or spaces are in contact with the atmosphere, and they are constantly giving off moisture into the air. If the upper ends of these tubes are covered, as with a board or a mulch, the evaporation into the atmosphere is relatively slight. If they are covered with a mulch of ashes or sawdust, a similar result may be attained. This dry earth-mulch may be made on the spot by tilling the upper two or three inches of soil. The philosophy of summer tillage is to prepare and to maintain this mulch of soil, thereby interposing a relatively non-capillary stratum between the moist

soil and the air. This earth-mulch may itself be dust-dry, but it protects the soil beneath. There is more or less evaporation into the interstices of the earth-mulch itself, and some of the moisture ascends through the mulch and escapes into the atmosphere; but it has been found by long experience and by experiments that the earth-mulch greatly lessens evaporation. The frequent stirring of the surface soil in summer is said to make the land moist; as a matter of fact, it keeps it moist. When it is impracticable to keep a surface mulch by means of tillage with horse tools or a rake, it is sometimes advisable to use straw or manure. Mulching newly set trees is often desirable when it is not possible to till the land or not practicable to water them. The ideal mulch to conserve moisture, however, is the loose soil, since the stirring of the soil not only affords the mulch but also sets at work various chemical and biological forces which make the plant-food more available.

All herbaceous plants and most shrubs are benefitted by a mulch in the fall, no matter how hardy they may be in the given locality. Nature's mulch is the debris of fallen leaves, grass and other litter. The autumn leaves which blow into the borders and the clumps of shrubbery, afford the very best winter mulch; and yet it is a common practice to scrupulously collect and burn these leaves in the fall, and then if the plants are mulched to apply manure. This is doubtful wisdom. The herbaceous border will be benefitted by a loose, open mulch, 6 to 10 inches deep. If the mulch is of such character as to become very hard and dense, and to hold too much water, it may be injurious. Leaf-mold, loose muck or peat, autumn leaves mixed with some litter which will prevent them from packing too hard, manure which is not too strong in nitrogen and potash, fine straw, sawdust, shavings, pine needles, evergreen boughs—these are some of the materials which may be used as a mulch to good advantage. If the mulch has thoroughly decayed by spring, it may be left on the land and it will make a fine loamy covering which will be much like the vegetable mold found in the woods. Too often the passion for cleanness sacrifices the welfare of the border. Persons will collect and burn every stray autumn leaf, but will not notice many kinds of dirt which are really objectionable.

The mulch keeps the surface of the soil loose and mellow because it protects it from the beating of heavy rains and the weight of snow. The vegetable fiber which works into the surface also prevents the particles of heavy clay soils from running together or puddling. Soils which are covered with a mulch do not bake.

Whenever the mulch contains soluble plant-food, the soil receives the leachings and is enriched. Stable manure is an ideal mulch for enriching the soil, but if the manure is fresh and strong, it is likely to injure the crowns of some plants. L. H. B.

MULLEIN. See *Verbascum*. **Mullein Pink.** *Lychnis Coronaria*.

MURRÀYA (J. A. Murray, 1740–1791, professor in Göttingen). *Rutàceæ*. Trees or shrubs without thorns: lvs. pinnate; lfts. ovate, rhomboid or elliptical-lanceolate, cuneate or oblique at base: fls. comparatively large, solitary and axillary, or in terminal corymbs or axillary cymes; sepals 5, ovate or lanceolate, united only at the base or in the lower third; petals 5, linear-lanceolate, free, imbricate; stamens 10, free, inserted on an elongated disk, the alternate shorter: ovary ovate, 2–5-celled narrowed into a long and finally deciduous style; stigma capitate; ovules solitary or 2, superimposed or collateral in each cell: fr. a small elliptical or round berry. Four species in Indo-Malay region.

exótica, Linn. Orange Jessamine. A very variable evergreen shrub or small tree: young branches pubescent: lvs. glabrous, 3–8-foliolate; lfts. oblique, short-petioled, about 1 in. long, obovate or elliptical, entire, shining above: fls. campanulate, ½ in. in diam., pure white, very fragrant: ovary 2-celled: fr. a small berry, elliptical, reddish, glandular-dotted, 1–2-seeded. India, China, Australia and the Pacific islands.—A tender tropical shrub, with dense foliage and of upright-bushy habit. Cultivated to some extent on lawns in southern Fla. and S. Calif., and in hothouses. A fine ornamental pot-plant, blooming when small. *Murraya exotica* "needs ample pot room and a liberal supply of plant-food. An annual application of bone-meal when repotting in February intensifies the color of the foliage, increases the size of the flowers, and causes it to bloom more frequently. When properly treated, the first crop of flowers usually appears here [Georgia] during May, another during July, and this is succeeded at intervals of from four to six weeks until fall. For winter, give it the temperature of a cool greenhouse, but during summer it thrives best when given full sunshine outdoors." *P. J. Berckmans*, A.F. 11:1367 (picture).

Kœnigii, Spreng. Lvs. 10–20-foliolate, pubescent or rarely glabrous. Along the foot of the Himalayas in India.—A small, strong-smelling tree. The bark, leaves and roots of this species are used in India as a tonic.

elongàta, DC. Lvs. 4–6-foliolate, glabrous; lfts. 4–5 in. long, much longer and more lanceolate than any form of *M. exotica*: bark on slender branches pale yellow. Burma.

paniculàta, Jack. Satinwood or Cosmetic Bark Tree. Arborescent: corymbs few-fld. or fls. solitary.—The wood of this species is considerably used because of its strength and endurance and light yellow color. The bark is used as a cosmetic. By some considered to be a form of *M. exotica*.

H. J. Webber.

1435. Mucuna pruriens, or Cow-Itch (× ⅓).

MÙSA (named after Musa, the physician of Augustus). *Scitamineæ*. Banana. Plantain Tree. Large herbaceous or slightly shrubby plants with immense undivided leaves, forming a very conspicuous fea-

ture in the tropical forests of the Old World, where alone it is native. Characterized by the elliptical pinnately-parallel-veined lvs. with the sheathing petioles forming a false stem-like structure: fls. unisexual, in clusters, each cluster subtended by a large, colored bract, and all arranged in a dense terminal panicle borne on a stalk rising through the center of the false stem; perianth of 6 parts, 5 of which are united in 1 piece, designated below for convenience as calyx, and 1 free, here termed the petal; perfect stamens 5: ovary inferior, 3-celled, many-seeded: fr. large, more or less elongated, indehiscent, pulpy or dry. Plants of great importance in the tropics, where the fruit is used for food. Bananas are imported into the U. S. in great quantities from Cuba and Central America, and are also grown in the Gulf states (see *Banana*). Several species are grown extensively in the North solely for decorative purposes. Latest monograph of the genus by Baker, Annals of Botany 7:205 (1893). K. M. Wiegand.

The principal species grown for its fiber is *Musa textilis*. Its cultivation is confined almost entirely to the Philippine Islands, where it is grown in immense dense groves. The product of this fiber Banana is known in commerce as Manila hemp. This species is a very tall-growing one, reaching a height of 20 or more feet. It produces an inedible fruit filled with seeds, from which it is readily propagated. It is little known in this country.

As decorative plants in landscape gardening few subjects equal the choicer species of Bananas. The immense leaves arching out gracefully from the top of the "stalk," which is in reality a bundle of long leaf-stems so closely united as to form, for practical purposes, a real stem, give an effect of tropical luxuriance. As they are of really easy growth, their cultivation in temperate climates is on the increase. The smaller species, some of them with mottled or variegated foliage, are most useful for bedding purposes on a small scale.

Young plants may be obtained from nursery or florist firms in the spring or early summer and kept growing in pots in the conservatory or house until settled warm weather permits open-air planting. They should then be given considerable space in a well-enriched bed, having a situation sheltered from the prevailing winds and where water can be applied during dry weather. The Banana is impatient of shade, doing its best in strong sunshine. Heavy winds tear the large leaves, and hence a sheltered location is best for preserving the beauty of the foliage. By autumn the plant will be large, and if desired to carry it on to fruiting, it should be carefully lifted into good soil in a large tub for growth under glass during winter. By the following summer it should be of sufficient age and size to bloom and fruit in the open ground. The plants may be stored in a light, frost-proof cellar during the winter, but by this means the foliage will be lost and the plant suffer a severe check. When it is desired merely to have their foliage for ornamental purposes, and fruiting the plant is not specially desired, the heavy tuberous roots may be deprived of tops and stored in dry sand through the winter. In the spring these will throw up shoots, if given heat and moisture in the greenhouse or hotbed. E. N. Reasoner.

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A. *Fruit edible, seedless (except rarely Nos. 3 and 4); petal ovate, entire.*
B. *Lvs. 2–3 ft. long; plant dwarf, 4–6 ft. high: fr. 6-angled: fls. 1 in. long.* ..... 1. **Cavendishii**
BB. *Lvs. 5–9 ft. long; plant taller, 8–30 ft.: fr. 3–5-angled: fls. 1½–2 in. long.*
C. *Foliage very glaucous beneath, firm: fls. rose-red.* ..... 2. **Martini**
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E. *Bracts bright red.* ..... 8. **coccinea**
9. **sanguinea**
EE. *Bracts pale blue or reddish lilac.* ..... 10. **rosacea**

1. **Cávendishii**, Lamb. (*M. Sinénsis*, Sagot. *M. Chinénsis*, Sweet). Chinese Dwarf Banana. Dwarf Jamaica. Stoloniferous: whole plant 4–7 ft. high: false stem cylindrical, 3–4 in. in diam.: lvs. conspicuously spreading, oblong, 2–3 ft. by 1 ft.; petioles short and stout; blade when young spotted and blotched with red, in age rather glaucous: panicle drooping: bracts ovate, dark reddish brown: male fls. persistent; calyx yellowish white; petal one-half as long: panicle very large, the fruits 200–250, small, 4–5 in. by 1½ in. or more, yellow, slightly curved, broad, obtuse, narrowed to the sessile base; skin thick, flesh delicate and fragrant. Southern China. Int. from Mauritius in 1829. Gn. 32, p. 243; 40, p. 263; 44, p. 496; 50. p. 161. G. C. III. 22:167.—Stands more cold than most Bananas, and its dwarf growth readily allows of protection. Good for planting in the North; good, also, for shipping. Grown extensively along the coast of the southern states and in the West Indies.

2. **Mártini**, Hort. Similar in habit to *M. sapientum:* lvs. oblong, long-petioled, quite thick and not easily broken by the wind; veins and stem commonly reddish: fruit rather small, yellowish. Int. from the Canary Isls. R.B. 18, p. 107.—A foliage plant good for exposed places.

3. **Basjoo**, Sieb. & Zucc. (*M. Japónica*, Hort.). Japanese Banana. Stoloniferous: whole plant 12–18 ft. high: false stem cylindrical, 6–8 in. in diam.: lvs. oblong, thin, 6–9 ft. by 1½–2 ft.; petiole about 1 ft. long: peduncle 1 ft. long: panicle dense, nodding: bracts dull brown: petal nearly equaling the calyx: fr. 30–60, oblong, pointed, 3 in. long, gradually narrowed to a sessile base, usually containing a few seeds. Liu-Kiu archipelago, cult. in Japan. B.M. 7182. R.B. 22, p. 152. R.H. 1896, p. 203. Gn. 55, p. 3.—Decorative; valuable because of its resistance to cold; may be planted at the North.

4. **sapiéntum**, Linn. Common Banana. Figs. 187, 188. Stoloniferous: plant 20–30 ft. high: false stem cylindrical, 4–6 in. in diam.: lvs. oblong, thin, bright green, 4–7 ft. by 1½–2 ft.; petiole slender, 1–1½ ft. long: panicle often 4–5 ft. long: bracts ovate-lanceolate: fls. 1¼ in. long: fr. in the typical form, 3–4 in. by 1½–2 in., forming 3–4 bundles of about 12 each, rounded above, narrowed to a sessile base, bright yellow; flesh good, seedless. Native in India and E. Indian Isls.—Widely cult. throughout the tropics for the excellent fruit, and also more rarely for the fiber, which is inferior to that of *M. textilis*. Most of the commercial Bananas are obtained from the numerous varieties of this species. The Ori-

noco, Horse or Hog Banana, is probably very near the typical form of this species. It is very hardy, and much grown in Gulf states: fr. 6–7 in. long, not good unless ripened on the plant. The Fig Banana resembles var. **Champa**, but small fruit purplish: dark lvs. and stem often blotched with black. Not hardy.

Var. **Troglodytàrum**, Hort. (*M. Troglodytàrum*, Linn. *M. Uranoscòpos*, Rumph, not Seem.). Rather dwarf: lvs. narrow-oblong: bracts greenish: panicle in fr. erect: fr. small, 2–3 in. long, nearly globular, reddish yellow or orange, rarely with a few seeds; flesh yellow, sweet and mawkish. India and Pacific Isls., rarely cult. in U. S.

Var. **Dácca**, Hort. (*M. Dácca*, Horan. *M. palústris*, Hort.?). Dacca Banana. Rather dwarf: stem glaucous: lvs. pale green, glaucous beneath: petioles with red margins: fr. yellow, 4 in. long by 2 in. wide, its tip and base bright green; flavor good; skin thick.—Tender, not good for cool climates.

Var. **Chámpa**, Hort. (*M. Chámpa*, Hort. *M. oriéntum*, Hort.). Hart's Choice. Lady Finger, or Golden Early Banana. Chumpa. Stem and midrib of leaf tinged with red: fr. pale straw-yellow, about 6 in. long; skin very soft and thin; flesh luscious and delicate in flavor, ripens quickly. Hardy in cool climates. Best of all for growing in Florida. Much grown in W. Indies.

Var. **paradisíaca**, Hort. (*M. paradisíaca*, Linn.). Plantain Banana. Cooking Banana. Adam's Fig. Male fls. more persistent: fr. 40–80 on a panicle, very large, 7–14 in. long, cylindrical, yellow, acutish; pulp firm and less saccharine, not very good unless cooked: lvs. 5–7 ft. and petiole 2 ft. long. India. R.H. 1888, p. 69. L.B.C. 7:684.—Cult. everywhere in tropics, especially in Cuba. Most commercial Bananas are of this variety. The Martinique Banana is probably merely a form with slightly smaller fruits (7–8 in. long). Immense quantities grown in W. Indies and Cent. Amer. Fine for shipping.

Var. **rùbra**, Hort. (*M. rùbra*, Firming). Baracoa Banana. Red Jamaica Banana. Red Spanish Banana. Stem, petiole, fls. and midrib of leaf dull red: fr. large, 7–9 in. long at first, dark red, ripening to a yellowish red, of very good quality.—This is the red Banana of commerce, formerly imported in large quantities from the W. Indies. Plant very large and stout, with erect lvs., and is one of the finest for decorative purposes, although not very hardy. The Golden Banana is intermediate between this and var. *Champa*: fr. golden yellow or reddish, 8–9 in. long, blunt.

Var. **vittàta**, Hook. Rather dwarf in habit: lvs. and the long fruits copiously striped with white and often also rose; spathes bright red inside. B.M. 5402.—Very decorative.

5. **Ensète**, Gmel. Abyssinian Banana. Fig. 1436. One of the largest species, very luxuriant: lvs. oblong, acutish, bright green, up to 20 ft. by 3 ft.; petiole short and broad; peduncle short; panicle nearly globose: bracts ovate, dark claret-brown: fls. whitish, 1½–2 in. long, 2-ranked, 20 or less in each rank; calyx strap-shaped; apex 3-lobed; petal short, central cusp long-linear: fr. coriaceous, dry, 2–3 in. long: seeds 1–4, black, glossy, nearly 1 in. broad. Abyssinia. G.C. II. 15:435; 21:19; III. 16:696. Gn. 47, p. 5; 48, p. 406. B.M. 5223. R.H. 1888, p. 32. V. 5:53 F.E. 11:470.—Most commonly cult. of all decorative Bananas, and probably the finest; also most hardy of all cult. forms, growing freely during the summer. Seeds germinate easily in hotbed.

6. **seminífera**, Lour. The typical form is not in the trade. Var. **zebrina**, Hort. (*M. zebrina*, Hort.). Very similar to *M. sapientum* in vegetative characters, but much smaller: axis of the panicle velvety: fr. small, oblong, full of seeds and not edible, yellowish or greenish in color: lvs. usually purple below and copiously blotched or striped with black or dark purple above.—A very fine ornamental variety.

7. **Sumatràna**, Becc. False stem 3 ft. high: lvs. oblong, 5–6 by 1½ ft., glaucous, blotched with claret-brown; petiole slender: peduncle hairy: panicle drooping, 1–1½ ft. long: male fls. deciduous: bracts short and rounded: female clusters few, distant: calyx 1 in. long: fr. cylindrical, curved, 2–3 in. by ½ in., narrowed suddenly to a slender stipe. Sumatra. I.H. 27:375.—Used for decorative purposes.

8. **coccínea**, André. False stem slender, 4–5 ft. by 2–3 in.: lvs. small, oblong, 2–3 ft. by 6–9 in.; petiole long and slender: panicle dense, erect, 6 in. long: female clusters few: bracts lance-oblong, bright red, tipped with yellow: calyx yellow, 1 in. or more long: seeds very small, oblong, rarely produced in cult. S. China. B.M. 1559. L.B.C. 5:475.—Very showy.

9. **sanguínea**, Hook. f. False stem slender, 4–5 ft. high: lvs. oblong, 2–3 ft. long, thin, bright green; petiole slender, 1 ft. long: paniele at first erect, finally drooping: female clusters 2–6, each 2–3-fld.: male clusters few, dense: bracts lanceolate, somewhat persistent: bright red: calyx bright yellow, 1½ in. long: fr. oblong-trigonous, 2 in. long, rather pulpy, pale green, variegated with red: seeds angled, small, black, tubercled. Assam. B.M. 5975.—Decorative and showy.

10. **rosàcea**, Jacq. False stem 3–5 ft. high, 3–4 in. in diam.: lvs. narrow, linear-oblong, firm, 3 ft. long, 9 in. wide, purplish beneath; petiole long and slender, panicle drooping or erect, about 1 ft. long: bracts ovate-lanceolate; rosy purple: male clusters more numerous than the female, deciduous: calyx yellow, 1 in. long: fr. oblong, obscurely 4–5-angled, yellowish green, 2–3 in. long: pulp very scanty and scarcely edible: seeds 2 lines in diam., black, tubercled, rare in cult. India. B.R. 9:706. L.B.C. 7:615.—Int. into California.

1436. Musa Ensete.

M. Fèhi, Vieill. (M. Seemanii, F. Muell.). Similar to M. sapientum. Lvs. larger and firmer: fr. 5–6 in. long, straight, yellow, edible, seedy. Cult. in Europe. G.C. III 8:182.—*M. rùbra*, Hort., differs from M. coccinea in its short petal (one-half length of calyx). Cult. in Europe. B.M. 7451.—*M. supérba*, Roxb. Similar to M. Ensete: trunk often 7–8 ft. in circumference at base: panicle drooping, one-third length of stem: calyx of 3 loosely cohering parts. Cult. in Europe. B.M. 3849, 3850. R.H. 1877, p. 277; 1888, p. 33. F. 1873, p. 273.—*M. téxtilis*, Née, Manila Hemp. Stem cylindrical, 20 ft. or more high: lvs. glaucous beneath, oblong, firm: petal long: fr. on drooping axis, green, 2–3 in. long, narrowed to a short, stout pedicel, not edible, filled with seeds. Most important of cordage plants. Immense quantities exported from the Philippines. Int. by Div. of Pomology, U. S. Dept. of Agric., in 1889, but no longer advertised.

K. M. Wiegand.

MUSCÀRI (Latin name referring to the musky odor of *M. moschatum*). *Liliàceæ*. Grape Hyacinths are charming, hardy, spring-blooming bulbs (see Fig. 1439). They are something like a hyacinth, but the clusters are smaller, and the individual fls. are smaller and of different shape. The fls. are more or less urn-shaped, constricted at the mouth and have 6 small teeth instead of

prominent perianth-segments, as in the true hyacinth. The common Grape Hyacinth, which every garden lover knows, is called *M. botryoides*, which means "like a bunch of grapes." Everybody who has any ground for gardening should have some bulbs of this common kind, both blue-flowered and white. All the other kinds described below are fanciers' plants, interesting chiefly to skilled amateurs. Among them the most remarkable is the Feathered Hyacinth (*M. comosum*, var. *monstrosum*), which is a mass of lilac shreds (see Fig. 1438). Any species of Muscari is likely to have some sterile fls. at the top of the cluster which are often of a different color, but in the Feathered Hyacinth there is no suggestion left of the urn-shaped flower, sterile and fertile fls. all being cut into fine strips. This attractive plant has lately been sold for fancy prices by a few progressive florists.

All Grape Hyacinths are very much alike and are very interesting, botanically, horticulturally and from the artistic point of view. There are perhaps 40 species in Europe, western Asia and northern Africa. The group needs botanical revision badly. The chiefly literary sources are Baker in Jour. Linn. Soc. vol. 11 (1871), and in G.C. II. 9:798 (1878); also Boissier's Flora Orientalis. The width of the lvs. is an important character, and Baker's measurements seem to refer to herbarium specimens. Live plants should be wider. (A line is a twelfth of an inch.)

W. M.

Grape Hyacinths are neat little early flowering bulbous plants, good-sized colonies of which give dainty effects in the border from February to May. There are numerous species of these, flowering at different times. They are mostly dark purple in color, either self-colored or tipped with white. There are also a few white and yellow forms, and several species with true blue flowers, the rarest color among flowers, though this would never be discovered in catalogues. *M. Szovitsianum*, one of the true blue forms, is quite the prettiest of the genus. The plant known to the trade as *M. lingulatum* or *Hyacinthus azureus* has the true blue of *M. Szovitsianum*, and is fully a month earlier. The usual forms grown in gardens are mostly blue (purple) and white forms of *M. botryoides*. *M. conicum* is very dark. The Dutch catalogues offer numerous kinds to suit purses in all stages of decrepitude. Muscari offer no difficulties in cultivation. A medium soil perhaps suits them best, but they are usually thrifty growers, and persistent in the garden if foliage is allowed to ripen. They mostly make offsets freely, and produce abundant seed.

J. N. GERARD.

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Subgenus I. MOSCHARIA. Perianth urn-shaped, but with a relatively long-tubular base; segments minute, even for the genus, roundish, spreading and thickened on the back..... 1. **moschatum**

Subgenus II. LEOPOLDIA. Perianth obovoid-urn-shaped, grooved above, 3–4 lines long; segments triangular, reflexed, not thickened on the back: raceme loose, and longer than in the next. Particularly characterized by the conspicuous bearded appearance of the sterile fls..... 2. **comosum**
3. **Græcum**

Subgenus III. BOTRYANTHUS. Perianth more or less urn-shaped, grooved or not above, 1–2 or rarely 3 lines long; segments triangular, usually reflexed: raceme dense, 1–2 in. long. Sterile fls. inconspicuously bearded or hardly at all.

A. *Fertile fls. a little longer than broad, i. e., obovoid-globose.*
B. *Lvs. 3–4: fls. 12–20*..... 4. **botryoides**
BB. *Lvs. 5–6: fls. 8–12*..... 5. **Heldreichii**
BBB. *Lvs. 2–3: fls. 6–10*..... 6. **lingulatum**
AA. *Fertile fls. 1½ times as long as broad, i. e., obovoid-oblong.*
B. *Color of fls. black-blue* ..... 7. **paradoxum**
BB. *Color lively dark lilac or blue.*
C. *Lvs. 3–4 lines broad* ..... 8. **conicum**
CC. *Lvs. 1–2 lines broad.*
D. *Fls. violet, fragrant*..... 9. **micranthum**
DD. *Fls. blue, faintly odorous*10. **Szovitsianum**
BBB. *Color nearly white* .....11. **pallens**
AAA. *Fertile fls. twice as long as broad, i. e., obovoid-cylindrical.*
B. *Lvs. almost cylindrical (subterete)* .....12. **racemosum**
BB. *Lvs. oblanceolate*.....13. **latifolium**
BBB. *Lvs. lorate, i. e., strap-shaped*.14. **neglectum**
15. **commutatum**
16. **polyanthum**
17. **compactum**

1. **moschâtum**, Willd. (*M. suavèolens*, Fisch.). MUSK HYACINTH. Lvs. 5–6, 1 ft. long, ½–¾ in. wide: raceme loose, 1–3 in. long: fls. 20–50, blue. Asia Minor. B.M. 734. Gn. 26, p. 137.—Has the odor of musk. Vars. **major** and **minor** are advertised. *M. dipcade major* and *minor* have appeared in the catalogue of J. M. Thorburn & Co. since 1878, but these names are not in Index Kewensis. Thorburn & Co. write that this is the Nutmeg or Musk Hyacinth, *Muscari moschatum*, and that *M. dipcade* still appears in Dutch catalogues.

Var. **flàvum**, Lam. (*M. flàvum*, Van Tubergen. *M. macrocárpum*, Sweet). Fls. yellowish (Van Tubergen says clear yellow). B.M. 1565.

2. **comòsum**, Mill. Fig. 1437. Lvs. 3–4, 1–1½ ft. long, ½–1 in. wide: raceme loose, 6–12 in. long, 40–100-fld.: lower fls. fertile, olive, tipped brown, borne on long horizontal pedicels: upper fls. sterile, blue or violet, borne on long up-curved pedicels, making a corymbose cluster. Mediterranean region, Orient. B M. 133 (as *Hyacinthus comosus*).—An interesting form, but rare in cult., being greatly surpassed in popularity by

Var. **monstròsum**, Hort. FEATHERED HYACINTH. Fig. 1438. All the fls. sterile, and cut up into fine shreds. Gng. 7:290. A.F. 14:1286. Gn. 26, p. 137.—A charming and novel plant. Also called Fair-haired or Tasseled Hyacinth, and Shredded Lilac. Sold also as *M. monstrosum*, *M. plumosum*, *M. plumosum monstrosum*, etc. For other trade synonyms, see under *M. commutatum*.

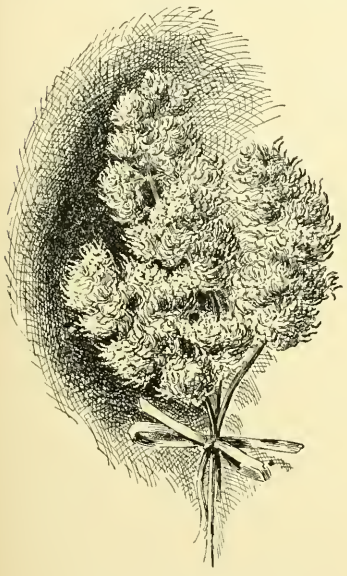
1437. Muscari comosum. (Adapted from Botanical Magazine.)

3. **Græcum**, Heldr. Differs from *M. comosum* in having its sterile fls. in a short, dense, conical spike, the pedicels of which are very short. Greece.

4. **botryoides**, Mill. COMMON GRAPE HYACINTH. Fig. 1439. Lvs. linear-lorate, 3–4 lines wide: scape 6–9 in. long: fls. pale blue, odorless. Eu., Orient. B.M. 157 (as *Hyacinthus botryoides*). A. F. 13:1197. Gn. 26:453. R.B. 20:3.—The following varieties are offered: *album*, *carneum*, *cœruleum*, *leucophœum*, *Lelievrei*, *majus*, *pallidum* and *pallidum grandiflorum*. These range from white through flesh-color to sky-blue.

5. **Heldreichii**, Boiss. Lvs. linear-filiform, subterete, 1½ lines wide: scape 4–6 in. long: fls. amethyst-colored, with conspicuous white teeth. Greece. Gn. 26:453.

6. **lingulàtum,** Baker (*M. Aucheri,* var. *lingulàtum,* Boiss.). Lvs. 3 lines wide: raceme ovate. Asia Minor.—According to Index Kewensis this is a good species, but



1438. Muscari comosum, var. monstrosum.
(Adapted from Gardening.)

J. N. Gerard says the plant sold under this name is the same as *Hyacinthus azureus.*

7. **paradóxum,** C. Koch. Lvs. 3, ½–¾ in. wide. Armenia.

8. **cónicum,** Baker. Lvs. about 6, narrower: fls. violet-blue. Habitat unknown. Gn. 51:1106 (?).—Van Tubergen says fls. black-blue.

9. **micránthum,** Baker. Fls. bright violet. Habitat unknown.

10. **Szovitsiànum,** Baker. Fls. bright blue, considerably larger (⅛ in. across, but only 1-12 in. across in *M. micranthum*). Persia, Caucasus. B.M. 6855.

11. **pállens,** Fisch. Lvs. numerous, filiform: scape 3–5 in. long: raceme 12–20-fld.: fls. white or nearly so. Caucasus, Iberia.

12. **racemòsum,** Mill. Lvs. 5–6, 5–6 in. long, 1–1½ lines thick: fls. odorous, dark blue. Mediterranean, Caucasus. B.M. 122 (as *Hyacinthus racemosus*).—Vars. *carneum* and *grandiflorum præcox* are offered.

13. **latifòlium,** J. Kirk. Lvs. always solitary, ¾–1 in. wide: sterile fls. 6–10, much paler than the others. Phrygia.

14. **neglèctum,** Guss. Lvs. numerous, 9–12 in. long, 1½–2 lines thick: fls. odorous, dark blue. Mediterranean region. Gn. 26:453.—This differs from *M. commutatum* and *M. polyanthum* in having the segments of the perianth triangular and reflexed. *M. neglectum multiflorum* and *M. neglectum Atlanticum* are trade names. See supplementary list under *M. Atlanticum.*

15. **commutàtum,** Guss. Lvs. 5–6, 5–6 in. long, 1½–2 lines wide: fls. odorless, dark blue; segments very short, not recurved. Sicily.—Krelage advertises vars. *atro-cæruleum, comosum, plumosum, plumosum monstrosum,* and *plumosum violaceum.* It is apparent that he regards *M. comosum* and its forms as varieties of *M. commutatum.*

16. **polyánthum,** Boiss. Lvs. 2–3 lines wide. Differs from *M. neglectum* and *commutatum* in having longer pedicels and the capsule a half smaller, not more than 2 lines wide.

17. **compáctum,** Baker. Described only as *Botryanthus compactus* in an obscure work, which states that the fls. are nearly black, with whitish teeth which are semi-orbicular, obtuse, spreading-recurved. Baker places *M. compactum* next to *M. commutatum,* in spite of the fact that the original description says the fls. are obovate. Baker adds that this *M. compactum* is the *M. neglectum* of some authors in part. The plant in the trade as *M. compactum* may be a variety of some common species, since Van Tubergen says the fls. are pale blue.

M. Argæi, little known botanically, is said to be extra good. In the trade, M. Atlanticum is given as a synonym. Baker said he could not distinguish M. Atlanticum from M. neglectum.—*M. Atlanticum.* Consult the preceding entry, M. Argæi.—*M. azùreum,* Hort., is said by Van Tubergen to be the same as Hyacinthus azureus, which in turn is referred to H. ciliatus by Index Kewensis. Gn. 36:713. Van Tubergen also advertises var. amphibolis (M. Freynianum).—*M. Motelàyi* is offered by Van Tubergen. W. M.

MUSÈNIUM (a name for fennel, another plant of this family). *Umbellíferæ.* Three species of resinous perennial herbs in middle and western North America, stemless or branching, decumbent or ascending, 2–12 in. high. Lvs. pinnately decompound: fls. yellow or white, in compound umbels: fr. ovate or ovate-oblong; ribs 5, filiform, slightly prominent, with 2 or 3 oil-tubes in the intervals. Coulter and Rose, Revision of North American Umbelliferæ, 1888.

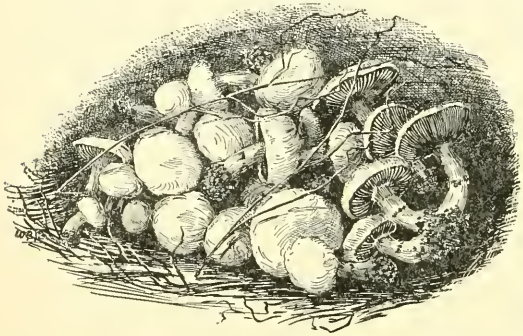
trachyspérmum, Nutt. (*M. divaricàtum,* var. *Hoòkeri,* Torr. & Gray). Decumbent: lvs., except the radical, opposite, bipinnatifid: fls. yellow: fr. scabrous. Spring. Saskatchewan to the Upper Missouri, the Platte, and S. W. Montana.—Procurable from dealers in western native plants.

MUSHROOM. While the word Mushroom is now often used as a general term for a large number of the higher fungi, chiefly those belonging to the Agaricini, it is by some limited to the common edible species in cultivation and which also grows spontaneously in

1439. Muscari botryoides (× ⅓).

lawns, pastures, etc. By others the word is employed for all edible species, while toadstool is employed to designate poisonous species; such persons usually make an incorrect application of these terms to many of the plants. The word is probably derived from the

French word "mousseron," and is sometimes pronounced "mushroons," or "musheroons" by English-speaking people in America. Mushroom and toadstool are sometimes used as synonymous terms, especially in speaking of the group as a whole. It is difficult, therefore, to give either a satisfactory definition of the word Mushroom, or satisfactorily to limit the range of forms for which the name may be used. In a horticultural sense



1440. The gardener's Mushroom, Agaricus campestris (×1·5).

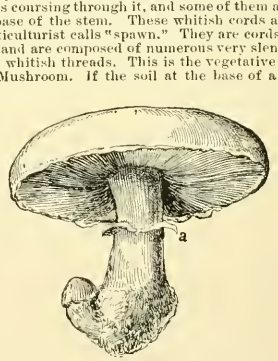
it is applied to *Agaricus campestris* (Fig. 1440) in cultivation, and since that is the plant with which we are first interested here, we may proceed at once to a description of its form, structure, development, etc., and follow with briefer descriptions and comparisons of a few of the many species belonging to this large group.

Form and Structure of Agaricus campestris.—The form of the common Mushroom is more or less umbrella-shaped, and is well represented in Fig. 1441. The prominent parts of the plant are the stem, with its ring (*a*); and the cap, with the gills on the under side. The cap, or pileus, as it is technically called, is the upper expanded part, and varies from 2 to 4 or 5 inches in diameter. It is usually white in color, but forms occur both in the field and in cultivation in which the upper surface is more or less brownish, especially as the plants become old. The surface is usually smooth, though it often presents a silky texture from the numerous minute fungous threads or mycelium, the structural element of the entire plant. While the surface is smooth in a majority of specimens, many forms are more or less scaly, due to the fracture of the surface and separation of the numerous small areas, especially in the specimens with brownish caps. The "flesh" or "meat" of the cap is white. The stem, or stipe, is usually cylindrical, 1–3 in. long by ½–¾ in. in diameter, whitish in color, and nearly or quite solid. The "ring," or annulus, forms a collar joined around the stem near the top. It is very delicate, easily rubbed off, and sometimes not present because the veil from which it is formed is torn in fragments as the cap opens out. The gills, or lamellæ, on the under side of the cap are of great importance in showing relationship, and also probably in reproduction in the case of plants propagated under natural conditions, since they form the fruiting surface of the Mushroom. The gills are in the form of narrow, thin plates, shaped somewhat like a knife-blade, attached by one edge to the under side of the cap and radiating from a point near the stem out to the margin of the cap. The longest gills extend for this distance and mark off triangular areas which are filled with successively shorter gills, all reaching the margin of the cap, so that the entire under surface of the cap is well covered with them. The surface of the gills is the fruiting surface of the plant, and this economy in the arrangement of the gills provides for a very large fruiting area. The color of the gills when the plant is very young is white. They soon, however, become pink in color, and as the plant ages become purple-brown or blackish in color, due to the immense number of spores borne on the surface. One can gain a good idea of the number of spores borne on a single plant by cutting a cap from a Mushroom, just at maturity, and placing it, gills downward, on a piece of white paper for a few hours. The spores fall from the gills and pile up in ridges, giving an exact print of the spaces between the gills.

The parts of the plants enumerated above are easily seen. Other important structural characters are seen with the aid of the microscope. A thin section across the gills when seen with the microscope shows the structure as seen in Fig. 1442. The middle part of the gill is the *trama*. On either side of the trama is the *subhymenium*, composed of branches from the trama and forming short cells. The cells of the subhymenium in turn give rise to the *basidia* (basidium), club-shaped bodies, which form a palisade layer of cells over the entire surface of the gill. This palisade layer of the basidia forms the fruiting surface, or *hymenium*.

At the end of each basidium are either 2 or 4 slender, pointed processes, the *sterigmata* (sing. sterigma). These bear each a single spore, the *basidiospore*. The usual number of sterigmata on the basidium in the Agaricini is 4; but in *Agaricus campestris* the number seems to vary from 2 to 4. In plants grown in a Mushroom house, 2 have been found, while plants from the field show 4. Whether the number 2 for cultivated forms is constant, or 4 for the field forms, has not been determined.

Development of Agaricus campestris.—The spores of the Mushroom in the field probably often germinate and produce new mycelium or "spawn," though this is not necessary for the continuance of the plant from one year to another, since the spawn can live through the winter in the soil, and the following year then spreads. In ordinary Mushroom culture, however, the spores probably play little part in the propagation of the plant, since this is accomplished by the growth and propagation of spawn. If the soil where plants are growing is carefully dug away there will be seen slender and irregular whitish cords coursing through it, and some of them attached to the base of the stem. These whitish cords are what the horticulturist calls "spawn." They are cords of *mycelium*, and are composed of numerous very slender and delicate whitish threads. This is the vegetative portion of the Mushroom. If the soil at the base of a tuft of



1441. Cultivated Mushroom, Agaricus campestris. (×⅔)

young plants in a Mushroom bed be washed away, a large number of these cords will be exposed. This is the part of the plant which grows and spreads through the soil, absorbing solutions of the organic matter in the soil for food.

Button Stage.—After an abundance of the mycelium, or spawn, is formed there appear here and there on the

cords small rounded bodies formed by the upward growth of the threads of mycelium. These increase in size and grow toward the surface of the ground. Each one is the young stage, or button, of the Mushroom. As it enlarges, the upper end appears as a round body on a short stalk, thus outlining in the embryonic stage the different parts of the mature plant. The gills are forming on the under side of the cap. They are at this time covered. They appear on the under side of the minute constriction at the junction of the cap and stem. At this stage they are covered by a loose growth of mycelium extending from the upper part of the stem to the margin of the cap. This forms the veil. The gills are formed by mycelium growing downward on the under side of the cap in radiating rows, thus forming the lamellæ. The plant now continues to enlarge and the cap expands. Just about maturity the veil ceases to grow and the expanding cap thus stretches it until finally the veil is ruptured, usually next the margin of the cap, and then it hangs as a collar or ring on the stem (seen at *a*, Fig. 1441).

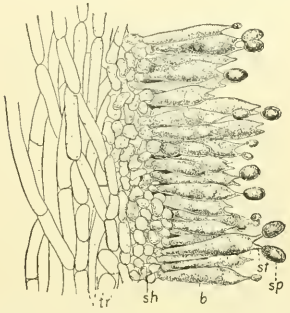
Position of Agaricus campestris in Classification.—One of the large subdivisions of the higher fungi is made up of the Mushrooms, toadstools, puff-balls, etc. All of these are characterized by a more or less well-developed fruiting surface, or *hymenium*. The structural element of the hymenium is the basidium, and in the large number of the species the form of the basidium does not vary to any great extent from that of the common Mushroom. The basidium, then, is the characteristic fruit structure of this large subdivision of the fungi. For this reason, the plants included in this subdivision are termed the *Basidiomycetes*. The Basidiomycetes, taken in the sense of the earlier students of the fungi, were divided into two orders, according to the condition of the fruiting surface at the maturity of the plant, namely the *Hymenomycetes* and the *Gasteromycetes*. In the former, the fruiting surface is either exposed from the beginning, or if covered at first, is at last exposed before the maturity of the spores, just as the hymenium of *Agaricus campestris*, at first covered by the veil, is exposed before the maturity of the spores by the rupture of the veil. The Mushrooms, toadstools, etc., belong, therefore, to the Hymenomycetes. In the Gasteromycetes, on the other hand, the spores are matured before the hymenium is exposed, as in the puff-ball, earth-star, etc., which open after the spores are ripe.

Families of the Hymenomycetes.—The usage of the earlier botanists in the arrangement of families will be followed here, since there is not an opportunity to properly set forth the principles of classification adopted by some recent systematic works. The arrangement depends on the character of the fruiting surface or hymenium.

A. Fruiting surface uneven; i. e., in the form of plates, tubes or spinous processes.
  1. Agaricaceæ, fruiting surface in the form of plates or gills.
  2. Polyporaceæ, fruiting surface in the form of pores or tubes.
  3. Hydnaceæ, fruiting surface in the form of spinous or tubercular processes.

AA. Fruiting surface even; i. e., not as in A, except in the case of plants of a gelatinous texture.
  4. Clavariaceæ, plants more or less erect, standing out from the substratum, and covered on all sides by the hymenium.
  5. Thelephoraceæ, plants either erect or diffused over the surface of the substratum, one side only (in the case of erect plants usually the under side) covered with the hymenium.
  6. Tremellineæ, plants of a gelatinous texture, various in form.

Agaricaceæ.—The common Mushroom, *Agaricus campestris*, belongs to this family. The family Agaricaceæ is made up of what are now popularly termed *agarics*. Very many of the species were once placed in the genus Agaricus. The genus became so large that it was subdivided into a large number of subgenera, many of which have recently been raised to the rank of genera. In thus subdividing the old genus Agaricus into a number of genera there has been a lack of uniformity on the part of systematists in the choice of a generic name for the common Mushroom. Saccardo retained the genus Agaricus for the common Mushroom and its near allies, although discarding the subgenus Psalliota. Some have employed the genus Agaricus, some Psalliota, others Pratella, and still others propose to restore the antiquated genus Fungus, and call our plant *Fungus campestris*. This is not the place for a



1442. Section of a gill of Agaricus campestris, enlarged.

Tr., trama; *sh.*, hymenium; *b.*, basidium; *st.*, sterigma; *sp.*, spore.

discussion of the merits of any of these names, but it seems better in the present instance, at least, to use the generic name Agaricus with the limits of Psalliota Fries.

Other Species of the Genus Agaricus.—There are a number of other species of the genus, as thus limited, which, because of their size and esculent qualities, are worthy of mention.

Agaricus arvensis, the Horse Mushroom, grows in grassy fields and pastures during the autumn. It is a larger plant than the common Mushroom, has a thicker cap, longer stem, and the veil is double, the lower or outer portion splitting radially into a star-shaped fashion and remaining attached to the inner portion. *Agaricus silvicolus*, the wood-inhabiting Mushroom, grows in woods. The whole plant is whitish, but tinged more or less with yellow, the cap is smooth, and the long stem has an abrupt and broad bulb. The veil is thin, membranaceous, but in some specimens shows a tendency to be double, as in *Agaricus arvensis*. *Agaricus Rodmani* grows along the streets of cities in the hard ground between the sidewalk and curbing, and similar places. It is entirely white, the cap thick and firm, the stem short, and with a short, thick, double annulus. *Agaricus fabaceus* (*A. subrufescens*, Peck) has a light reddish brown cap, a long stem somewhat enlarged below, and a ring which has soft scales on the under side formed, much as in *A. silvicolus*, from the cracking or splitting of the outer layer. The plant has the taste and odor of almonds. It grows in greenhouses. It sometimes grows in compost heaps. It often forms large clusters of many individuals. It has been successfully cultivated. *Agaricus silvaticus* grows in woods during late spring and summer. It is a large plant, usually about the size of the Horse Mushroom, but thinner, and with numerous minute dark scales on the surface of the cap, which form a solid patch of dark color at the center. In age, the cap is more or less flat, and it has been called the flat-cap Mushroom (*A. placomyces*). The stem is long, enlarged below, and the ring is double, exactly as in the Horse Mushroom. *Agaricus comtulus*, a small species, rather rare, but with a wide distribution, is regarded with suspicion by some.

Coprinus.—In the genus Coprinus, 3 of the edible species are quite common. The spores are black and the gills and more or less of the cap dissolve at maturity into a black fluid.

Coprinus comatus, the Shaggy-mane Mushroom, or Horse-Tail, occurs in richly manured lawns or parks in early spring or late autumn. It is white in color, with a cylindrical cap 3–4 in. long and 1–2 in. in diameter. The cap is very shaggy, the scales often being black in color, while the gills are at first salmon color. The ring on the stem is free and movable. It is one of the best of the edible Mushrooms.

Coprinus atramentarius, the Ink-cap, grows in similar places. The cap is oval, from 1–3 in. long and nearly as wide. It is nearly smooth, and grayish in color. The ring is fixed and not at all prominent; best seen just as the margin of the cap is parting from the stem.

Coprinus micaceus, the glistening Coprinus, grows about old stumps and from old roots or other buried and rotten wood. It is smaller than the two species enumerated above, and tan in color, the cap when fresh being covered with thin, loose, flaky scales which glisten in the sunlight like mica particles, but they are easily rubbed off or washed off by rains.

Lepiota.—Of the white-spored agarics the genus Lepiota, with an annulus on the stem and the gills usually free from the stem, contains several edible species. *Lepiota procera*, the Parasol Mushroom, grows in pastures, lawns, and sometimes in gardens. *Lepiota naucina*, the smooth Lepiota, grows in similar places and is entirely white.

1443. The deadly Amanita. Amanita phalloides.

Amanita.—The genus Amanita is closely related to Lepiota, and contains, besides several edible species, a number of poisonous ones, a few of which are the most deadly of all the Mushrooms. Amanita possesses the characters of Lepiota, with the additional character of a volva, or prominent universal veil, forming an outer layer of greater or lesser thickness and composition, which is ruptured as the cap expands and the stem elongates. In Lepiota the universal veil is not prominent, and it is further closely united with the surface of the cap. The volva in Amanita is often left as a prominent cup-like structure at the base of the stem (see Fig. 1443), and because it is present in some of the poisonous species is known popularly as the "poison cup," "death cup," etc. It is present, however, in some of the edible species.

Amanita phalloides, the deadly Amanita (Fig. 1443), is one of the most fatal species. It is 4 to 6 in. high, and the cap is 2 to 4 in. in diameter. The cap is dark gray or umber, or whitish with a yellowish tinge, or quite yellow, or in some forms, especially European ones, the cap is green. In other cases the whole plant may be entirely white. The volva in typical forms splits at the apex as the young plant is expanding, and is left as a cup with prominent lobes, as shown in Fig. 1443. In other cases the volva is ruptured irregularly, so that portions of the universal veil are left on the surface of the cap. In still other cases the volva splits in a circumscissile fashion, that is, circularly or transversely about the middle, the lower half remaining attached to the surface of the bulb at the base of the stem, while the upper half remains loosely attached to the upper surface of the cap, and is torn apart into scales as the cap expands. In these forms the volva forms a narrow rim or margin on the outer angle of the bulb, so that the latter appears saucer-shaped. The cap is rather slimy when moist. These great variations in this very poisonous species should make the novice very cautious regarding the species of Amanita, or indeed any species of Mushroom with which he is not quite familiar. This species of Amanita usually occurs in woods or groves or in the margins of woods, while the *Agaricus campestris* or the *Lepiota naucina* occur usually in open grassy places. But these differences of habitat cannot be relied on altogether, for the deadly Amanita, especially the white form, has been found in lawns far from woods, and in such cases might be mistaken for the smooth Lepiota, since this is white in color. The deadly Amanita is usually deeply seated in the ground, so that the stem might be broken in gathering it when the volva would be left in the ground, and it might easily be mistaken for some species of Lepiota.

Amanita verna, the Destroying Angel, is by some regarded as only a white variety of *A. phalloides*. The entire plant is white, the volva splits at the apex, and thus a prominent free limb of about three lobes remains at the base of the stem. The free limb remains more or less closely applied to the stem. The annulus is broad and entire, and hangs down as a broad collar from the upper part of the stem.

Amanita virosa is very near *A. verna*. It is distinguished only by the torn veil, portions of which remain clinging to the margin of the cap, and by the scaly character of the stem, characters which show every gradation into *A. verna*. Both are deadly poisonous.

Amanita muscaria, the Fly Agaric, is also a poisonous species, though not so dangerous as those named above, since the poisonous effect can be counteracted if treatment is promptly employed. The volva splits transversely into several concentric, interrupted rings which persist as scaly rings on the upper part of the bulb on the base of the stem, and as scattered scales on the surface of the cap. The cap is yellowish or orange-yellow, sometimes red in color, and in age sometimes fades out so that white forms appear. The gills are usually white, as are also the ring and the stem. *Amanita Frostiana* is a closely related species with the same color on the cap, but with yellowish gills and veil, though variations in the color are shown in different plants when the cap only may be yellow. The scales are usually yellow, but may also be white.

Of the edible species may be mentioned *Amanita Cæsarea*, the "Royal Agaric" or "Cæsar's Agaric." The cap is bright orange or yellow, with prominent striæ or furrows on the margin. The gills are orange, though the spores are white. The veil and stem are often yellow, especially in the larger specimens. The volva splits at the apex and is left at the base of the stem as a cup with a prominent free limb, which usually fits closely to the stem. The volva is white, and rarely are portions of it left on the surface of the cap. It is a very beautiful species, occurring during late summer and autumn in woods, and is more common in the southern states than north.

Amanita rubescens, another edible species, has a volva which is more or less friable, that is, it crumbles more or less into loose particles which easily wash off from the cap as well as from the base of the stem. The entire plant has a dull reddish tinge, and when bruised or cut quickly changes to a deeper reddish color due to a reddish juice in the plant. Small forms of the species do not show the color so well.

Amanita solitaria, the Solitary Amanita, is one of the largest species of the genus. It is almost pure white, the surface of the cap often being grayish, and sometimes with tints of brown in the scales, especially in old plants. It grows in rather open woods or by roadsides in woods. The volva is entirely broken up into mealy particles which easily rub off, or there are conic scales, especially toward the center of the cap. The veil is very delicate and easily torn into shreds, which disappear soon. The stem has a large bulb, which tapers into a long, root-like process in the soil. The plant is said by some to be edible. *Amanita strobiliformis* is a closely related species, if it is not identical with it, and is said

by some to be poisonous, so that caution should be employed in eating plants of this form unless one is certain of the species and of its edible qualities. *A. strobiliformis* is rarely found in this country, and judging from the characters of certain plants ttributed to it, there is a strong suspicion that it is only a form of *A. solitaria* with large scales.

Other native Mushrooms of economic importance may be mentioned:

Armillaria mellea, the Honey-colored Agaric, occurs in late summer and during the autumn about old stumps, and from roots. The plants are clustered, the cap is more or less covered with pointed blackish erect scales, the gills are attached to the stem, and an annulus is present. The plant is also a parasite, especially on the roots of coniferous trees, in some instances killing the trees. It develops under the bark long black cords of mycelium. The plant is edible.

Pleurotus contains several edible species: the oyster agaric, *P. ostreatus;* the elm Pleurotus, *P. ulmarius;* and the sapid Pleurotus, *P. sapidus*, all growing on tree trunks, stumps, etc., especially abundant in the autumn.

Tricholoma personatum, "blewits," is regarded as an excellent edible species. It grows on the ground in woods. When young, the entire plant is of a pale lilac or violet color, the color fading out in age. The spores are of a light ochre color.

Cantharellus cibarius is the well-known chanterelle. It is yellowish in color, grows in woods on the ground, is somewhat irregular top-shaped, and the gills are mere folds, which run irregularly from the stem to the margin of the cap, and are much branched. It is one of the best edible species.

Marasmius oreades, the well-known Fairy Ring, or champignon, grows in lawns and pastures. It is white, with a cream-colored cap. It often grows in the form of rings on the ground, though not always.

The genus Lactarius contains a large number of species. The plants are more or less fleshy and are characterized by the presence of a milky juice contained in a system of tubes throughout the plant. This juice exudes in drops when the plant is bruised or cut. In the larger number of species the juice is white in color, in some it changes on exposure to the air to various shades of yellow, while in others the milk is orange, blue, etc., from the first. *Lactarius deliciosus* is one of the best of the edible species, as its name indicates. The milk is orange in color. The plant is dull orange in color and marked on the cap with concentric zones of darker color. In age bruises of the plant become more or less tinged with green. *Lactarius volemus* is dull orange in color, the color being uniform, the flesh quite firm, and the milk white, sweet and very abundant, quickly exuding in large drops or running from cut or cracked portions. *Lactarius corrugis* is closely related but darker in color, sometimes dark brown, the gills also being dark ochre-brown in color. Both species are excellent, and grow in the woods during summer and autumn. *Lactarius piperatus* is entirely white, with close and narrow white gills, and abundant milk which is very hot or peppery to the taste. It is said to be edible, but should not be confused with certain species having peppery milk, which are reputed to be poisonous. *Lactarius vesimus* is another white species with white and very hot milk, which is suspected. *Lactarius Indigo* is of an indigo-blue color, with faint zones of a darker color on the cap, and with a dark indigo-blue juice.

The genus Russula is closely related to Lactarius, but lacks the milky juice. In this genus occur many of the brilliant-colored agarics. The entire plant is more or less brittle and easily breaks, the gills of many species crumbling easily when rubbed. *Russula lepida*, with reddish cap and stem, white gills with the red color from the cap extending a short distance on the ends of the gills, taste mild, is an edible species. Another edible species, *Russula alutacea*, has a reddish or purple cap, but the gills and spores are ochraceous in color. The taste is mild. *Russula emitica* is a poisonous species. The cap is rose-color or red, the cuticle easily peels off from the cap, the margin of the cap is deeply furrowed and warty along the ridges, the stem is white or reddish and the taste of the plant is peppery.

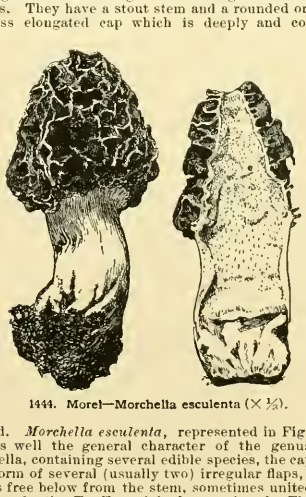
Of the tube-bearing Fungi (*Polyporaceæ*) the genus *Boletus* contains a number of edible as well as poisonous species. In shape the plants are like the Mushroom, but they have a porous surface instead of gills on the under side of the cap. *Boletus edulis* has a yellowish or dull brownish cap, pores white and closed at first, but yellowish or greenish yellow in age. *Boletus felleus* (poisonous) is of about the same size and resembles the edible species closely, but the tube surface is pink or flesh-color, and the taste is bitter. In the genus *Polyporus* most of the species grow on wood, trees, stumps, logs, branches, roots, etc. The sulfur polyporus, *P. sulphureus*, forms clusters of sulfur-yellow bracket-like caps, on various broad-leaved trees or stumps. *Polyporus frondosus* grows from roots at the base of dead oak stumps, forming large irregularly branched leafy masses with gray caps and whitish stems and pore surface. Both of these are edible.

In the spine-bearing Fungi (*Hydnaceæ*) the under surface of the cap presents numerous spine-like processes. *Hydnum repandum*, in shape like a Mushroom, with the cap more or less irregular, and of a buff or cream color, is an excellent edible species. The Coral Hydnum, the Bear's Head, the Medusa's Head, and *Hydnum erinaceum*, all growing on trees, all white in color, and branched, or forming large masses from which long spines dangle, are all edible.

The Club Fungi (*Clavariaceæ*) are all said to be edible. The Horn of Plenty, *Craterellus cornucopioides*, funnel-shaped, and smoky in color, with a smooth under surface, belongs to the *Thelephoraceæ*, and is edible.

Among the Puff-balls (*Lycoperdaceæ*) all the species when young and white inside are edible, that is, they are not poisonous. Some are better to the taste than others. The two best ones are the Giant Puff-ball, *Lycoperdon giganteum* and the *Lycoperdon cyathiforme*. Both of these grow in lawns or fields, the former grows sometimes to a large size, several feet in diameter; while the latter is 4 to 6 inches in diameter.

Besides the Mushrooms proper which belong to the Basidiomycetas, certain of the large Ascomycetes are edible and are usually included in treatises on Mushrooms. In the Ascocomycetes the spores are borne on the inside of a club-shaped body called the *ascus*, and this is the chief point of difference in them from the Basidiomycetes. To the Ascomycetes belong the following. The Morels grow on the ground in damp places. They have a stout stem and a rounded or more or less elongated cap which is deeply and coarsely



1444. Morel—Morchella esculenta (× ½).

pitted. *Morchella esculenta*, represented in Fig. 1444, shows well the general character of the genus. In Helvella, containing several edible species, the cap is in the form of several (usually two) irregular flaps, sometimes free below from the stem, sometimes united with it. Lastly, the Truffles might be mentioned. They are subterranean Fungi rounded or globose in form, firm,

and contain the spores inside of the rounded mass within sacs. Few have been found in this country, because they have not been diligently searched for.

GEO. F. ATKINSON.

Mushroom Culture. There is no science of Mushroom culture. That is to say, one does not know why he fails. This is equivalent to saying that he does not know why he succeeds. By practice and experimenting one hits upon or develops a method, and if he persists he may become very skilful, but it is next to impossible for him to impart his knowledge. If he writes an article, he describes his method in detail and deprecates other methods; but the learner will be as likely to succeed by some other method, and neither man will know why. There are few people, if any, who succeed uniformly with Mushrooms. Beds made the same day and of the same material, planted from the same spawn, and similarly cared for, may give very different results. One bed may fail outright, and another may produce a good crop. Persons who make uniform commercial success of Mushroom-growing accomplish it by having many beds or by proceeding on a rather large base: it is infrequent that all the beds fail. The biological problems concerned in the propagation, growth and appropriation of food of the Mushroom must be understood before one can lay down principles for the culture of Mushrooms.

Decaying vegetable matter, a uniform and rather low temperature, a uniform supply of moisture,—these are the general requisites for Mushroom-growing. The decaying matter is supplied by horse manure. The manure is allowed to heat and is turned several times before it is placed in the bed. The heating itself is probably of no advantage except as it contributes to the decay of the material: heat can be supplied by other means if necessary. The broken and decaying manure is placed a few inches or a foot deep in beds. When the temperature is reduced to 90° or less the spawn is planted. As soon as the bed has cooled sufficiently, it is covered with earth or litter to regulate the temperature and moisture.

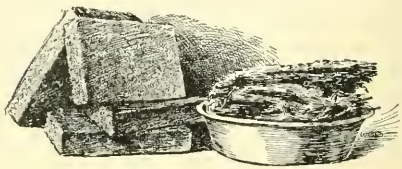
The cultivated Mushroom is native in temperate climates. In the United States and Canada it grows naturally in fields and pastures. But it is grown indoors: this is because the conditions can be better controlled under cover, particularly the temperature. Now and then some one makes a success of growing Mushrooms out of doors, but this practice does not promise much for most parts of America. In parts of Europe, growing in the open is more successful. Cellars or pits are favorite places in which to grow Mushrooms. The conditions are uniform. Caves are favorite places in which to grow Mushrooms, because of the slight fluctuations of temperature and moisture. Cellars and caves are dark: thereby has arisen a belief that darkness is essential to the growing of Mushrooms, but this is an

1445. A clump of young Mushrooms (× ⅓).

error. They often grow well in an unscreened greenhouse. Pastures are not dark. Spawn may be planted in a lawn, and Mushrooms will sometimes come; but it is seldom that the conditions are right for a crop.

Mushrooms are in edible condition at any time from their first appearing above the ground to the time when the rim of the cap begins to turn up and the flesh to lose its softness. See Figs. 1440, 1441. For pickling, "buttons" are usually preferred; these are the young Mushrooms (Fig. 1445) taken before the cap has expanded.

Mushrooms are propagated by spores and spawn, usually the latter. Spawn is the mycelium. It may be dried, and will resume growth when congenial conditions are given. It will keep for a number of years in a cool, dry place. Dryness is essential. This spawn may be secured from any place in which Mushrooms are growing. The soil or manure containing the mycelium



1446. Mushroom spawn.
English spawn, or "bricks," on the left; French or "flake" spawn on the right.

is broken into large lumps or flakes, and is planted in the desired place; the mycelium spreads through the bed and in time bears the fruiting stage or Mushroom. Formerly the spawn was gathered as needed, but since about 1830 it has been made or produced as a commercial product. For this purpose the spawn is grown in some prepared material, which may be dried and transported. The making of spawn is a business of itself. The English make and use the spawn mostly in brick-like masses of earth and manure (Fig. 1446). The French use also a spawn borne in a loose litter-like material (Fig. 1446), although not all of the French spawn is made in France. The English or brick spawn comprises nine-tenths of the spawn used in America. The brick is made of a mixture in about equal parts of horse manure, cow manure and loam. These are wet and mixed until the material has the consistency of mortar. The material is then spread on a floor and is allowed to dry until it can be cut into pieces, or "bricks." While the bricks are still moist, a hole the size of a walnut is made in the brick and fresh spawn is inserted. The bricks are then placed under cover or in a mild hotbed, where they are given such conditions as will cause the mycelium to penetrate them thoroughly. When the mycelium has ramified throughout the mass, and the surface has a cloudy look, the brick is dried and stored. This brick may be likened to a yeast cake.

Expert Mushroom-growers believe that spawn which is made over and over again from the mycelium tends to become weak and to produce small crops of thin-fleshed Mushrooms. They believe that the spawn now and then should be inoculated afresh from the spores. Spawn made directly from the spores is known as "virgin spawn." It is made by incorporating the abundant spores of ripe Mushrooms with the material of which spawn is made. It is probable that many of the large, thick Mushrooms which come up in odd places in the greenhouse arise from spores.

Mushrooms have been known as edible products from very early times. Pliny mentions them, but his writings are mostly warnings not to eat them because they are poisonous. He places them "among those vegetable productions which are eaten with risk." The following are some of his remarks respecting the Mushroom:

"The generative principle of the Mushroom is in the slime and the fermenting juices of the damp earth, or of the roots of most of the glandiferous trees. It appears at first in the shape of a sort of viscous foam, and then assumes a more substantial but membranous form, after which, as already stated, the young Mushroom appears. In general, these plants are of a pernicious nature, and the use of them should be altogether rejected; for if by chance they should happen to grow near a hobnail, a piece of rusty iron, or a bit of rotten cloth, they will immediately imbibe all these foreign emanations and flavours, and transform them into poison. Who, in fact, is able to distinguish them, except those who dwell

in the country, or the persons that are in the habit of gathering them? There are other circumstances, too, which render them noxious; if they grow near the hole of a serpent, for instance, or if they should happen to have been breathed upon by one when just beginning to open; being all the more disposed to imbibe the venom from their natural affinity to poisonous substances. It will therefore be as well to be on our guard during the season at which the serpents have not as yet retired to their holes for the winter. The best sign to know this by is a multitude of herbs, of trees, and of shrubs, which remain green from the time that these reptiles leave their holes till their return; indeed, the ash alone will be quite sufficient for the purpose, the leaves of it never coming out after the serpents have made their appearance, or beginning to fall before they have retired to their holes. The entire existence of the Mushroom, from its birth to its death, is never more than seven days."

Two hundred years and more ago Mushrooms were cultivated. The following directions, given by Philip Miller in 1754, are very like methods which are sometimes advised to-day, with the exception of the method of securing the spawn:

"In order to cultivate them, if you have no Beds in your own, or neighboring Gardens, which produce them, you should look abroad in rich Pastures, during the Months of *August* and *September*, until you find them (that being the Season when they are produced); then you should open the Ground about the Roots of the Mushrooms, where you will find the Earth, very often, full of small white Knobs, which are the Off-sets, or young Mushrooms: these should be carefully gathered, preserving them in Lumps with the Earth about them: but as this Spawn cannot be found in the Pasture, except at the Season when the Mushrooms are naturally produced, you may probably find some in old Dunghils, especially where there has been much Litter amongst it, and the Wet hath not penetrated it to rot it; as likewise, by searching old Hot-beds, it may be often found: for this Spawn hath the Appearance of a white Mould, shooting out in long Strings, by which it may be easily known, where-ever it is met with; or this may be procured by mixing some long Dung from the Stable, which has not been thrown on an Heap to ferment; which being mixed with strong Earth, and put under Cover to prevent Wet getting to it, the more the Air is excluded from it, the sooner the Spawn will appear: but this must not be laid so close together, as to heat; for that will destroy the Spawn: in about two Months after, the Spawn will appear, especially if the Heap is closely covered with old Thatch, or such Litter as hath lain long abroad, so as not to ferment: then the Beds may be prepared to receive the Spawn: these Beds should be made of Dung, in which there is good Store of Litter; but this should not be thrown on an Heap to ferment: that Dung which hath lain spread abroad for a Month or longer is best: these Beds should be made on dry Ground, and the Dung laid upon the Surface: the Width of these Beds at Bottom should be about two Feet and an half, the Length in proportion to the Quantity of Mushrooms desired: then lay the Dung about a Foot thick, covering it about four Inches with strong Earth: upon this lay more Dung, about ten Inches thick; then another Layer of Earth; still drawing in the Sides of the Bed, so as to form it like the Ridge of an House; which may be done by three Layers of Dung, and as many of Earth. When the Bed is finished, it should be covered with Litter, or old Thatch, to keep out Wet, as also to prevent its drying: in this situation it may remain eight or ten Days; by which time the Bed will be in a proper Temperature of Warmth to receive the Spawn; for there should be only a moderate Warmth in it, great Heat destroying the Spawn, as will also Wet; therefore when the Spawn is found, it should always be kept dry until it is used; for the drier it is, the better it will take in the Bed: for I had a Parcel of this Spawn, which had lain near the Oven of a Stove upward of four Months, and was become so dry, as that I despaired of its Success: but I never have yet seen any which produced so soon, nor in so great Quantity, as this.

"The bed being in a proper Temperature for the Spawn, the Covering of Litter should be taken off, and the Sides of the Bed smoothed; then a Covering of light rich Earth, about an Inch thick, should be laid all over the Bed; but this should not be wet: upon this the Spawn should be thrust, laying the Lumps two or three inches asunder: then gently cover this with the same light Earth, above half an inch thick; and put the Covering of Litter over the Bed, laying it so thick as to keep out Wet, and prevent the Bed from drying: when these Beds are made in the Spring or Autumn, as the Weather is in those Seasons temperate, so the Spawn will then take much sooner, and the Mushrooms will appear perhaps in a Month after making: but those Beds which are made in Summer, when the Season is hot, or in Winter, when the Weather is cold, are much longer before they produce.

"The great Skill in managing of these Beds is, that of keeping them in a proper Temperature of Moisture, never suffering them to receive too much Wet: during the Summer-season, the Beds may be uncovered to receive gentle Showers of Rain at proper times; and in long dry Seasons the Beds should be now-and-then gently watered; but by no means suffer much Wet to come to them: during the Winter-season they must be kept as dry as possible; and so closely covered, as to keep out Cold: in frosty or very cold Weather, if some warm Litter, shaken out of a Dung-heap, is laid on, it will promote the Growth of the Mushrooms: but this must not be laid next the Bed; but a Covering of dry Litter between the Bed and this warm Litter: and as often as the Litter is found to decay, it should be renewed with fresh: and as the Cold increases, the Covering should be laid so much thicker. If these Things are observed, there may be plenty of Mushrooms obtained all the Year: and these produced in Beds are much better for the Table than any of those which are gathered in the Fields."

Probably the first book in English to be devoted exclusively to the Mushroom was written in 1779 by John Abercrombie, London, and published under the title of "The Garden Mushroom: Its Nature and Cultivation. A Treatise, exhibiting Full and plain Directions, for producing this desirable Plant in Perfection and Plenty, according to the true successful Practice of the London Gardeners." Aside from the manner of securing the spawn, the advice given by Abercrombie would apply very well at the present day. He says that the spawn may be obtained from the dung of horse stables, from hotbeds, composts, cucumber and melon beds, old Mushroom beds, livery stable yards, horse mill-tracks, old dung-heaps where "some straggling Mushrooms are seen to rise naturally in the autumn," in kitchen-gardens in which Mushrooms have been seen, and in old pastures and meadows. The best season to find the spawn is in the autumn and the early part of winter. The frequent occurrence of Mushrooms in the covered mill-tracks, where horses worked on tram-cars and on power machinery, led to the use of the thoroughly tramped manure as spawn. This spawn gave very excellent results, probably because it was partially seeded from the spores of the Mushrooms which ripened there and were tramped into it. It is probable that this mill-track spawn gave rise to the idea of the Mushroom brick, which is now the chief means—at least, in England and America—of growing Mushrooms. The name "mill-track" is still used as a trade name for Mushroom spawn, although very little, if any, of it really comes from mill-tracks.

In America there is only one book devoted wholly to the growing of Mushrooms. This is by William Falconer and known as "Mushrooms: How to Grow Them" (1891). The Department of Agriculture and one or two experiment stations have issued bulletins on the subject.

L. H. B.

For Mushrooms, a supply of fresh horse manure should be procured, if possible each morning, that from grain-fed carriage horses being the most desirable. The strawy portion we discard. The manure is thrown in a heap on the floor of an open shed, and is turned over each morning for a few days. Before the heat of the manure has subsided sufficiently to permit the bed being made, mix about one-third as much loam screened through a ¾-inch sieve as there is of manure. We have had better success with loam mixed with the manure than when it was not used. The rank heat having escaped from the heap, it can at once be made

into a bed, a depth of from 9 to 12 inches being about right. The manure is placed in layers and pounded as hard as possible with a wooden mallet or brick; it can be well trodden where treading is possible. We spawn when the temperature of the bed has subsided to 90°. It is a little unsafe to spawn at a higher temperature, and if left until the heat drops below 80°, Mushrooms will be much more tardy in appearing and of poorer quality. English Milltrack spawn usually gives the best results. The spawn is broken into pieces as large as a walnut and inserted 2 or 3 inches deep, some 4 or 5 in. apart each way, pressing the surface firm after the insertion. Ten days later 2 inches of good loam is spread over the surface and pounded in hard. The beds are then covered with meadow hay or straw, and, given proper atmospheric conditions, should require no further attention until after Mushrooms have appeared, which may be in four weeks or not until four months later. The time when the first buttons will appear is very uncertain. It does not do to be of a highly strung nervous temperament in Mushroom culture. We have spawned beds and despaired of success, when we have been gratified by getting a first-class crop thirteen to sixteen weeks after spawning.

A dry atmosphere is inimical to the well-being of Mushrooms, and success is uncertain where such conditions exist. It is generally conceded that watering the beds often does more harm than good, but it must be remembered that the fact of the bed becoming dry only retards the production of the crop, and does not lessen the chance of Mushrooms appearing once the bed has become sufficiently moist. If the beds are made very compact there is less probability of them drying out and less likelihood of their injury by any sudden excess of either drought or moisture. When water has to be given we prefer to use it of a temperature of 85° to 90° and to water only the dry portions of the bed, which are wetted as evenly as possible.

When the first crop is exhausted and the bed has become somewhat dry, we use warm water and add a little nitrate of soda to it, covering the surface with hay after watering. This usually induces a good second crop to come.

We start to collect manure for the beds early in September, and continue to do so until early November. Usually the beds are made under the benches of some of the houses, where a temperature of 55° to 60° can be maintained, but any cellars or caves where such a temperature can be kept up are even better than greenhouses for Mushroom culture. The beds are always kept as dark as possible. Cockroaches, wood-lice and other pests must be poisoned or trapped, else they soon ruin a crop.

W. N. Craig.

Mushroom-growing is interesting work, and it is the uncertainty that is the cause of it. Most Mushroom-growers are in doubt when spawning their beds as to whether Mushrooms will appear, or the work be a failure. The writer has had excellent success with Mushroom culture and remarkable failures. Failures in a Mushroom crop are not easy to explain. The fault may be in making up the bed, or it may be in the spawn. A few years ago a bed was spawned with three lots of spawn; two beds were a success, while the other was a complete failure,—a proof that the bed is not always the cause of failure. Mushrooms may be grown successfully under the greenhouse benches, providing the drip can be kept off the beds; also in cellars; but the preference is for a Mushroom house built for that purpose. The house of which the writer has charge is built into a bank in such a position as to require very little fire heat to keep up the temperature. Of course air-spaces must be provided in the walls, according to the size of the house.

Two methods of making the beds may be described: (1) Collect fresh horse manure until there is enough to make a bed. The manure should be kept where it can be protected from rains, an open shed preferred. Turn the manure every other morning for a week, or until danger of burning is over. In making the beds, from 9 in. to a foot of manure is used. Beds should be thoroughly firmed, putting in a layer of manure, then firming, then another layer, until the desired depth is secured. Assuming that the bed goes up after making to 100° or 110°, then gradually drops, it is safe to spawn at 90°. Spawn should be inserted in the manure say 2 or 3 in. deep, and about 5 in. apart. In a week or ten days after spawning, cover with 2 in. of good loam. Good loam from the pasture, soil from the garden, and also old rose soil have been used with good results. It is customary to mix a little soil through the manure before making the bed. After the soil is on the bed and firmed down, a covering of straw will be beneficial, as it prevents the beds from drying out. Should they dry out, water must be applied, which should be at a temperature of 75° or 80°. Mushrooms should be gathered from six to eight weeks after making the bed. Keep the house at a temperature of 55° to 60°. (2) The second method, which seems to be the better, is for every load of fresh horse manure to add a load of old thoroughly rotted manure, or a load of old Mushroom manure. The aim is to get enough old manure to prevent the other from burning. The two are mixed, and the following day the bed is made. This method does away with a great amount of labor turning the manure; the bed also has a tendency to hold the moisture a greater length of time. The details of making the bed are the same as in the other method. This is a simple way to make the beds, but the results will follow with as much certainty as with any other method.

William Turner.

The writer's first trial with Mushrooms was made in a soap box under a bed, and the Mushrooms did well. That was 45 years ago. The next year he went into the business on a larger scale, growing them in the cellar, and a good crop was the result. He received $1.50 a pound, or $220 for the lot. A cellar under the parlor was devoted to the crop, and $350 worth was sold. Then a place was built under the ground with good ventilation, but it was not a success. The drip was too much. A cellar under the carriage house, which had no drip, made a good place, leading to the belief that a place with a Mushroom house under a building is the best place in which to grow them. They need a dry place. If we have a dry summer and light rains in September, or heavy dews, we will pick plenty of Mushrooms in the fall outdoors. In growing Mushrooms, we must imitate nature. The money that is wasted for spawn alone in one year would make a fortune for some persons. People get wild to grow Mushrooms. Some secure a crop, but others get nothing. The young man must try a little at a time. He should learn from the experiences of different men. A man can make money in this business, and he can lose it. The writer has had failure and success, but he now grows two tons every year.

Mushroom spawn runs best in anything that is dry. It is difficult to find out what moisture is wanted, and to get the material in the right state. The writer prefers to secure his manure on the cars fresh from the stable. Turn it over eight or nine times, once every day, so it will not burn, and put in dirt. To twenty tons add five cart-loads of earth. This earth is secured from sod from the hedges around the farm, taken the first of June and piled up to rot, so it will be ready for mixing in the manure. When the manure is in the right state, put it in beds 8 inches deep. The beds (made in houses) are made up like bunks on a ship and are 100 feet long, 4 feet wide and 3 feet between the beds to allow a man to go through with a wheelbarrow. One house is 20 feet wide. It contains 13 beds 100 feet long. It is heated by hot water and the temperature is kept at 60°. There are three large houses, and all of them with greenhouses on top, where lettuce, cauliflower, parsley, rhubarb and radishes are grown with the same heat that grows the Mushrooms. English spawn is used. It should be fresh and new. The spawn is placed 6 inches apart in the beds, in pieces the size of a black walnut. When the heat goes down to 90° the spawn is put in, and in six weeks the Mushrooms are ready for picking. The beds last from three to four months. The Mushrooms are packed in boxes and shipped to New York.

S. W. Wortman.

The Trade in Mushrooms.—The trade in Mushrooms has grown from a supply of 30 to 50 pounds a day to the enormous quantity of one-half to three-quarters of a ton. In fact, the trade has increased in proportion with

Plate XIX. Types of Muskmelons

In the fruit-dish, varieties of Forcing Melons. In the opposite corners, Netted Melons. In the upper right-hand corner, the snake Cucumber, *Cucumis Melo*, var. *flexuosus*.

the price, according to demand and supply. The best season for the consumption of Mushrooms is the late fall and winter months, as they keep in the cool, dry weather for several days, and small dealers have no trouble with them spoiling on their hands. The price during these months varies according to supply and demand. In the summer months a few will do well, but they spoil so readily in the heat that dealers do not care to handle any stock; therefore, if there were a large supply from June until October they would surely go to waste. The growers generally take advantage of this and renew their beds in summer, and prepare for the coming season. One great mistake is that the small grower is too anxious to reach the consumer. He wants to save the little which the middleman or distributer gets, and he gives them to the retailer, to restaurants, or to others, and these persons often take advantage of him. He is sometimes compelled to take from 25 to 50 per cent less than market price, and he injures the market as well. All classes now buy Mushrooms. If the supply is scarce and price high, they go only to the better class of hotels and restaurants; but as the price gradually decreases the consumption increases and the poorer grade of hotels and restaurants and families consume them. The consumption of canned and dried Mushrooms is not increasing as rapidly as that of the fresh-grown, and we are led to believe that in the near future our home-grown Mushrooms will be canned and dried as the foreign are; in fact, some of the canners are now making ketchup of the seconds and poorer grades. We believe that the consumption can be doubled and possibly trebled at a good profit if sold at half the present prices. We expect to hear before long of some house that will make a specialty of Mushrooms and sell nothing else.

ARCHDEACON & CO.

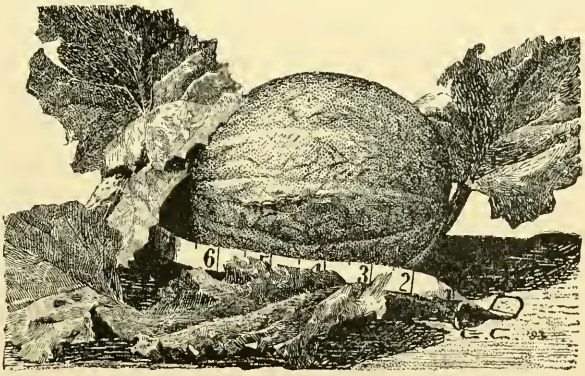
MUSK. The common Musk Plant of the gardens is *Mimulus moschatus*, an American plant. The wild Musk Plant of Europe, however, is *Erodium moschatum*.

MUSK HYACINTH, or Grape Hyacinth = *Muscari moschatum*.

MUSK MALLOW = *Hibiscus moschatus*. The Musk seed of commerce is also *Hibiscus moschatus*. **Marsh M.** is *Althæa officinalis*.

MUSKMELONS (Plate XIX) are now a very important commercial product in North America, and the cultivation and use of them are increasing rapidly. The hot, bright climate suits them well. Muskmelons thrive best in a light and quick warm soil. Since they are very susceptible to frost and are a long-season plant, it is important that they secure a foothold very quickly when put in the field; and this they are not able to do on lands which are not well prepared or which are naturally hard and clayey. If Muskmelons must be grown on such land it is advisable to make the hills. This is done by digging out a half-bushel or bushel of earth and replacing it with well-mixed loam and short manure. The plants are then able to secure a quick hold on the soil and to become thoroughly established before the dry weather of July and August.

In the southern states, the seeds of melons are usually planted in the field where the crop is to mature. In the northern states, however, the plants are started in forcing-houses or hotbeds. As a rule, hotbeds are more satisfactory than forcing-houses, since the plants can be hardened off better. In forcing-houses, the plants are likely to be too hot, even though there is no pipe heat, and they tend to become very soft. Plants which are tender, soft and light green when put in the field will nearly always suffer, even though the weather is not cold thereafter. In hotbeds the plants are nearer the glass, and the sash may be stripped entirely on all fair days, thereby allowing the plants to become gradually inured to field conditions. Melons transplant with difficulty; therefore they are always grown on pieces of inverted sods or in some temporary receptacle. Some growers employ pint and quart berry-baskets, such as are used for raspberries and strawberries. Others use a basket-splint which is about 3½ in. wide and 14 in. long, and which is cut in a basket machine at such distances that when the splint is bent it will make a four-cornered receptacle like a berry-box without top or bottom. The ends of this splint are held together by a single small tack. These forms may be packed together tightly in the hotbed and filled with earth and two or three seeds planted in each. When the plants have acquired two or three rough leaves, they are ready to be placed in the field. The forms can be taken from the hotbed by running a spade or shingle underneath them. With the fingers, the box is pulled apart and the cubical mass of earth is dropped into the hole made for it, and the plant receives no check. There is so much loss from the depredations of the striped beetle and the flea-beetle that one must provide several times more plants than the area requires. The hills of melons are usually from 4 to 6 ft. apart either way, and two or three plants are sufficient for a hill; it is advisable, however, to place at least half a dozen plants in each hill if the insects are troublesome. It is an excellent plan to plant squashes in the field before the melons are transplanted and to gather the insects from them for a week or two. Spraying the plants with Bordeaux mixture will repel the insects to some extent. Dusting with tobacco dust or snuff will also prove more or less efficient. Land plaster in which there is a little kerosene or turpentine is also repellent. The insects are killed by Paris green, but because of the hairy nature of the melon leaf it is almost impossible to cover the foliage completely with the poison.

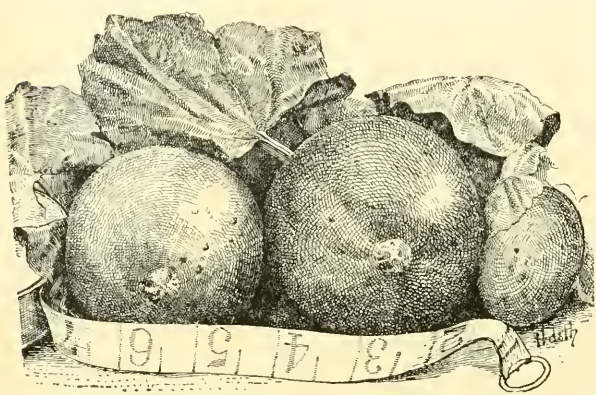


1447. A nutmeg Melon—the St. Laud.

There are two general types of commercial Muskmelons in North America—the furrowed and hard-rinded kinds, which are known as cantaloupes, and the netted and softer-rinded types, known as nutmeg or netted melons (Fig. 1447). In the southern states the word cantaloupe is used generically for all melons, but this use of the term is erroneous (see Cucumis, page 408, Bailey, A. G. 14: 206; Waugh, G. F. 8: 183). The various strains of netted melons are the ones mostly grown in the North for the home garden and for early market. The cantaloupes are mostly longer-season varieties.

Two important strains of the netted melon type which have come into great prominence in recent years are the Osage, developed in southwestern Michigan, and the Rocky Ford, developed in Colorado. Another important strain of the same class is the Montreal Market, which has developed in Canada. These three melons are grown on a very large scale for the market, and there are middlemen who now make a specialty of the melon crop in its season.

Some of the forms of the Muskmelon species are very unlike the ordinary Muskmelons. Some of them are scarcely edible in their raw state, but are used for



1448. The Orange or Chito Melon—Cucumis Melo, var. Chito.

pickles and conserves. Of these are the so-called Snake Cucumber (Plate XIX) and the Orange or Chito melon (Fig. 1448). The latter has been much advertised in recent years as a preserving or mango melon (for making "mangoes" or mixed pickles). It is a small-leaved slender vine as compared with the common Muskmelon, and it bears an abundance of yellow or orange fruits the size of a hen's egg or lemon. It requires no special culture. The Snake Cucumber is grown mostly as a curiosity in this country, but it may be used for pickles and preserves.

Another type of Muskmelon is the winter melon. These are described as follows in an Experiment Station publication (Bailey, Bull. 95, Cornell Exp. Sta.):

"There is an interesting class of melons, little known in this country, which gives fruits of long-keeping qualities. These are known as the winter or scentless melons. They are mostly of an oblong shape, with green or grayish hard rinds and commonly a white or green flesh, which often lacks almost entirely the characteristic aroma of the Muskmelon. The leaves are generally longer and greener than those of the common melons. The fruits are picked just before frost, when they appear to be as inedible as squashes, and are stored in a fruit-room to ripen. The true winter melons require a long season. We have planted them upon good soil on the first day of June, and they have barely come to maturity before frost. There is little difficulty in keeping some of the varieties until Christmas, if they do not get too ripe in the field, if the fruits are not allowed to become frost-bitten, and if the room is cool and rather dry.

"There are two general types amongst the winter melons which we have grown. One type has a solid interior, like a cucumber, and the seeds are imbedded firmly in the structure of the fruit. The other class has a soft interior and the loose seeds of ordinary melons. To the first class belongs the Winter Pineapple, a variety which seems to me to be indistinguishable from the Green-fleshed Maltese melon (*Melon de Malte d' Hiver à chair verte*) of the French. It is variable in shape and size, but is commonly pyriform and clear yellowish green, with a green inodorous flesh of fair quality for its class.

"There are a number of good varieties in the second, or loose-seeded class. The one which we have liked best is the French Winter Climbing Nutmeg (*Melon Brodé vert grimpant*). It has a sweet and good green flesh. The seeds are very small. The fruit is small, ribbed and very dark green with yellow furrows. It keeps well until December. Another good melon is the White Antibes of the French (*Melon Brodé d' Antibes blanc d' Hiver à chair verte*). It is an egg-shaped melon of good size, bright green until full maturity, and hard shelled. It is a very long keeper. The Redfleshed Maltese melon excels other melons of this class in quality, the flesh being aromatic and rich, but is not so good a keeper as the green-fleshed sorts.

"In general, these winter melons are worth growing for home use. The quality is not so good as that of the summer melons, but this defect is over balanced by their long-keeping qualities. Amongst prominent varieties are the Winter Climbing Nutmeg, the White Antibes and perhaps the Winter Pineapple. These melons are also useful for the making of conserves."

For other melon types and for a sketch of the botany of them, see the article in Vol. I on *Cucumis*. L. H. B.

The Muskmelon, a fruit of much commercial value, is grown in different localities under varied methods. Where they are grown in largest quantities, as in the South, the simplest methods are employed. There the seed is dropped in hills of well-enriched soil, three to five to each hill, and covered with about 2 in. of soil; when there is danger of chilly weather after planting, they are covered with litter or straw until the soil and temperature become warm. Among private gardeners throughout the country, and where climate and soil will admit, melon-growing is followed with a great deal of care and trouble, mainly because the area which they require to produce a fair percentage of good fruit cannot be allotted them, and consequently close care and best cultivation are required. The first thing is to provide a frame or pit, in which, after a slight hotbed has been made, and upon which the soil to the thickness of about 2 in. has been placed, the sash will be only 12 in. from the soil. Then place pieces of evenly cut sod 2 in. thick by 4 in. square, with the grass side down, on the soil, laying them close together, the edges touching, and with a sharp-pointed trowel dig out the center of each piece of sod, barely penetrating through, and fill up the space dug out with good soil, somewhat sandy. In each of these places drop two seeds, either of Musk- or Watermelon; keep slightly moist and also well protected during night and cool days and when there is no sunshine. After they start special care must be exercised to keep them growing, but not too fast, as the roots will penetrate the sod, and the plants will wilt when transferred to the open ground. The matter of ventilating and other care is easily given, and they can be transferred at will when the weather permits, as they will bear the transplanting without being injured. The transferring must be done by taking out each piece of sod with a trowel and setting in the open ground where wanted, making the hills of Watermelons 6 ft. apart each way and the Muskmelons 3 ft. in the rows and 6 ft. between the rows.

Another excellent operation employed by gardeners for the quick growing and full development of the finest

Emerald Gem Muskmelon, one of the standards of quality

fruit is the placing of well-rotted manure at the bottom of each hill. It is necessary that this be thoroughly rotted, as the paramount idea is to feed the roots with moisture and nutriment which this will supply. The best plan of preparing for this manuring is to dig holes a full spade deep, then fill up to within 4 in. of the surface with the manure, then cover with 3 in. of soil. This can be done several days prior to putting out the melons. The object of this expensive treatment is to furnish the roots with food and moisture through the heated season and induce a free growth, which will overcome scalding and also attacks of enemies.

The above methods will apply to both Musk- and Watermelons. The soil best suited to melon-growing is a sandy loam. When the soil is of a clayey nature and heavy, a free use of sand is beneficial. Muskmelon-forcing is followed successfully on some of the large and fully equipped private places. For this only a limited number of varieties are used—principally the orange-fleshed sorts with prominent netting on the exterior. Growing by this method is treated under the head of *Forcing*.

Muskmelons are a staple article among the people of Persia, Italy and also the Egyptians. The thin-skinned Persian types are yet grown, and noted for being very sweet and of fine flavor, and are better grown on very light soil. The counties in southern New Jersey along the coast supply the large markets of eastern cities with the famous Cassaba, or Persian, the seed of this variety having been originally procured from Smyrna; the inland growers adhere to such varieties as the famous Jenny Lind, Hackensack, Green Citron, Netted and Miller Cream. The varieties introduced in recent years of the orange-fleshed sorts are the Emerald Gem, Osage, Triumph and Paul Rose, and the green-fleshed Rocky Ford. These are an acquisition, and find ready sale when properly grown, being of medium size and quite solid: they endure transportation well. The famous Montreal Market variety, so much used in Boston, commands a very high price. It is one of the best for transportation and for keeping qualities; of yellowish gold color and fine flavor. It can be found in all eastern Canadian markets.

Muskmelon-growing is conducted on a large scale in the southern states, but only for their local markets. The valley of the Mississippi is particularly adapted for this industry. New Jersey supplies one-half of the Muskmelon crop; the seashore trade is the most extensive known, and as this market is so accessible to the grower, many farmers have their entire farms taken up for this purpose. They also have a method, not practiced elsewhere, which is a good one for extending the picking season over a long period. Their first planting is 3½ x 5 feet, and two to four weeks later they plant again between the hills, thus prolonging picking season in the same patch, and giving a full stand of plants in the field with minimum labor. The varieties grown by the largest planters are the Jenny Lind, Golden Jenny, Netted Gem and Green Citron, and only in very recent years have they added such varieties as the Emerald Gem and Triumph.

J. Otto Thilow.

MUSTARD, species of Brassica (which see), chiefly *B. alba, nigra, juncea* and *Japonica*. There are two types of Mustard-growing,—for the leaves, which are used as a vegetable; for the seeds, which yield oil and are used as a condiment. Table Mustard (the flour) is the product mostly of *Brassica nigra*, although seeds of *B. alba* and *B. juncea* are also used for making it. The Mustards often become prolific weeds, but since they are annual, they are easily kept in check by means of good farming (see *Weeds*).

As a culinary vegetable, Mustard is used for "greens" (which see). For this purpose, the large soft basal leaves are desired. These leaves grow best in early spring, although they do fairly well in the fall. If sown late in the season, the plant makes few bottom leaves and run quickly to seed Perhaps the best of the Mustards for greens in this country is *Brassica Japonica* (Fig. 255, Vol. I.), a species which has long been grown in this country, but which has no other well-known name than "Mustard." This often seeds itself and comes up the following spring. Some of the large-leaved forms of Chinese Mustard (*Brassica juncea*) are excellent, and should be better known. One of the oriental species (*B. napiformis*) makes an edible turnip-like root (Fig. 263, Vol. I.). Mustard needs a rich quick soil for the producing of the best foliage. Sow the seeds in drills 1 ft. or more apart, and thin to 6 in. in the row.

L. H. B.

MUSTARD, CLOWN'S. *Iberis amara.*

MYALL. See *Acacia.*

MYENIA of the trade is a misspelling of *Meyenia.* See *Thunbergia.*

MYOPÒRUM (Greek words referring to the translucent resinous dots in the lvs.). *Myoporàceæ.* About 20 species of shrubs, ranging from Australia and New Zealand to China and Japan. One of them was once a favorite heath-like plant in France. Two others are quick-growing shrubs, with a profusion of small, white, 5-lobed fls., and ornamental berries. These two are desirable for planting near the seacoast in S. Calif.

In 1883 it was stated in the Garden that for 20 years many thousand plants of *M. parvifolium* had been sold annually in the flower markets of Paris. One grower always had a stock of 30,000 plants. The plants were grown in small pots for room and window decoration in spring. An eye-witness said, "It is most beautiful as seen with its pale green branches drooping gracefully around the pot sides, and more especially so when the shoots are wreathed with sweet, snow-white blossoms." This species is practically unknown in England and America. Full details of the French method of culture are given in Gn. 24, p. 409. The American gardener may get some general suggestions from the experience recorded under *Epacris* and *Erica*.

Myoporums are erect and tall, or diffuse, glabrous or glutinous: lvs. alternate, rarely opposite, entire or toothed: fls. axillary, usually clustered, small or medium sized, usually white; calyx 5-cut or 5-parted, somewhat bell-shaped or funnel-shaped, the tube very short or long; lobes usually 5. The genus is divided into 5 sec-

1449. Myoporum lætum (× ⅓).

tions based on the shape of the fls., the number of the corolla-lobes and stamens, which vary from 4–6, and the number of cells in the ovary, which vary from 2–10. Usually the calyx segments are small and narrow, but in one section they are large and leafy.

A. *Lvs. lanceolate.*

lætum, Forst. f. (*M. perforàtum*, Hort.). Fig. 1449. Lvs. 2–4 in. long, lanceolate or obovate-lanceolate, acute or obtuse, finely serrate above the middle, bright green, shining: fls. white, 4–9 lines wide, with rounded lobes, which are hairy inside. New Zealand.

AA. *Lvs. linear.*

parvifòlium, R. Br. (*M. álbum*, Hort.). Procumbent shrub: stems 2 ft. long or more: lvs. ¾–1 in. long, linear or linear-spatulate, thick, sparingly dentate toward the apex: fls. with rather acute lobes which are woolly within. Austral. B.M. 1693. L.B.C. 9:837. Gn. 24, p. 361. V. 7:20.—Not advertised in America.

M. verrucòsum, Poir., is offered. Franceschi writes that it is a quick-growing shrub, and among the best plants to grow near the sea. He says it has pretty white fls. and purple berries.

W. M.

MYOSOTÍDIUM (Greek, *like a forget-me-not*). *Boraginàceæ*. A genus of only one species, known as the Giant Forget-me-not. It comes from the Chatham Islands, off New Zealand, and is neither hardy nor suited to general greenhouse culture, but it should be tried by some of our expert southern amateurs. The individual fls. are about ¾ in. across, and as many as 30–60 in a cluster. A plant grown outdoors in Cornwall, England, had about 20 such clusters. The fls. are 5-lobed and not a pure blue, being whitish toward the margins. They are borne on a stout, succulent stem 1½ ft. high. The root-lvs. are very large and numerous, heart-shaped, and with stalks 9 in. long.

This choice plant first flowered in Europe in 1858, but the whole stock died, apparently without flowering again. About 1883, fresh seeds were imported, and in a few favored localities in England the plant succeeded. In 1890 it was offered in America. Writers in "The Garden" give the following hints as to culture: The plants require plenty of air and should be well syringed in warm weather and shaded from the midday sun in summer. They should be kept absolutely free from insects, particularly aphids. The fine specimen grown in the Cornish garden (Gn. 50, p. 150) was placed under a high wall with a southern aspect, and sea sand piled about the roots.

As a genus, Myosotidium is close to Myosotis, but Bentham & Hooker consider its flowers nearest to Cynoglossum and its fruits nearest to Rindera.

nòbile, Hook. Giant Forget-me-not. Root-lvs. glabrous, glossy, succulent, parallel-veined, obtuse or retuse; petioles thick, grooved above. B.M. 5137. Gn. 30:575 and 50, p. 150. G.C. II. 25:681; III. 21:293. G.M. 31:219. J.H. III. 32:327.

MYOSÒTIS (Greek, signifying *mouse-ear*, from the leaves). *Borraginàceæ*. Forget-me-not. Scorpion Grass. A large genus of low, perennial or annual, more or less hairy, branching, diffuse or erect herbs, inhabiting both the north and south temperate zones, but the cultivated forms coming mainly from Europe. Lvs. alternate, entire: fls. small, in 1-sided, bractless, at first recurved, terminal racemes; calyx small, 5-cleft; corolla salverform, 5-lobed, the throat crested; stamens 5, included: ovary of 4 almost separate lobes, in fruit forming 4 smooth nutlets attached to the receptacle by their bases. The following are all hardy at the North and are grown in America mainly for out-of-door planting. The fls. are normally blue, often purple when young and turning blue with age. White-fld. forms (var. alba) of all the species may occur. J. B. Keller writes that Forget-me-nots prefer moist, half-shady places, but that an open, sunny border will do if it is not excessively dry. The perennials are easily propagated by division or cuttings.

A. *Hairs of the calyx all straight, appressed: perennials.*

B. *Lobes of the calyx much shorter than the tube.*

palústris, Lam. True Forget-me-not. Stems from slender, stolon-like rootstocks, slender, decumbent, and rooting below, appressed, pubescent or nearly glabrous, 6–18 in. long: lvs. oblong-lanceolate or oblanceolate, nearly sessile: raceme loosely-fld.: pedicels in fruit much longer than the calyx, spreading; lobes of the calyx deltoid, acutish: corolla bright blue, with a yellow eye, limb flat, 3–4 lines broad: nutlets angled and keeled on the inner side. May, June. Europe, Asia. G.C. III. 22:307. Gn. 52, p. 461.—Requires damp, shady ground. Escaped from cult. in the eastern states. Var. **sempérflorens**, Hort., is a dwarf form, 8 in. high, flowering all summer.

BB. *Lobes of the calyx as long as or longer than the tube.*

láxa, Lehm. Similar to the preceding species, and also rooting at the lower nodes, pubescence all appressed and scanty or wanting; racemes even more loosely-fld.: calyx lobes much longer, ovate-lanceolate, acute; corolla limb smaller and concave, about 2 lines broad, paler blue; throat yellow; nutlets equally convex both sides. May, June. North Europe, Asia, Amer.—Grows best in muddy places.

Azórica, H. C. Wats. Decumbent at the base and diffusely branched, 1 ft. high, densely setose-hispid, with reflexed hairs: lvs. oblong, obtuse or retuse, appressed hairy above, hirsute with reflexed hairs below: racemes sub-secund, dense: calyx almost 5-parted; teeth linear, spreading, clothed with erect, appressed hairs: pedicel about equaling the calyx: corolla larger than in the last, 3–3½ lines broad, deeper indigo-blue; throat with a whitish eye. Azores. B.M. 4122. V. 6:75.—Suitable for planting in damp, shady soil. Var. **cœléstina**, Hort., is a form with light blue fls.

AA. *Hairs of the calyx, or at least some of them, hooked, spreading.*

B. *Corolla small, about 1 line broad: limb concave: calyx hairs all hooked.*

arvénsis, Lam. Annual or biennial, erect, branched, 7–20 in. high, hirsute-pubescent: lvs. oblong or oblanceolate, sessile, obtuse or acutish: raceme loosely-fld.: pedicels in fruit much longer than the calyx: calyx deeply 5-parted; lobes equal, linear, acutish; corolla blue or white, 1–1½ lines broad: nutlet convex outside, keeled inside. June–Aug. Eu., Asia.—Will grow well in dry ground.

BB. *Corolla larger, 3–4 lines broad: limb flat: calyx with only the lower hairs hooked.*

sylvática, Hoffm. Perennial, hirsute-pubescent, and either green or cinereous, erect, 1–2 ft. high, branched above: lvs. oblong-linear or oblanceolate, nearly sessile, acutish: pedicels usually much exceeding the calyx: calyx deeply cleft, hirsute, the hairs, except a few at the base, erect and straight: racemes long and loose: corolla blue, 3–4 lines broad, with a yellow eye: nutlets more or less margined and carinate ventrally, sessile. Spring. Dry soil, Eu., N. Asia.—Common in cultivation.

Var. **alpéstris**, Koch (*M. alpéstris*, F. W. Schmidt). Differs from the type only in its dwarf habit, 3–8 in. high, more dense raceme, with shorter, thicker, ascending-pedicels, rarely longer than the calyx: nutlets larger. Summer. Eu. G.C. III. 17:650.—Flowers said to be fragrant in the evening. Var. **stricta**, Hort. All the branches erect and strict: appearance peculiar. G.T. 45, p. 609. Var. **aùrea**, Hort. Foliage golden yellow.

dissitiflòra, Baker. Biennial: very similar in habit to *M. sylvatica*, but lower, 6–8 in. high, whole plant clothed with erect-spreading or appressed short hairs: lvs. large, spatulate-oblong, acute, bright green: fruiting racemes more elongated: pedicels ascending or incurved, 2–3 times longer than the calyx: hooked hairs almost absent: calyx segments lanceolate, much longer than the tube; corolla 4–5 lines in diam. The most important difference is in the nutlets, which are distinctly stipitate. Spring. Switzerland. R.H. 1896, p. 278.—Var. **elegantíssima**, Hort. Lvs. white-edged. The name *M. elegantissima* has also been applied to forms of *M. valustris* and *sylvatica*.

K. M. Wiegand.

MYRÍCA (ancient name of no application). *Myricàceæ*. This includes a Japanese fruit tree which bears black or red fruits something like a blackberry. It was introduced to cult. in Calif. in 1889 under the name of *M. rubra* and fully described in the "Pacific Rural Press," from which the following account is chiefly derived. The tree attains 40–50 ft. The foliage is magnolia-like, evergreen and leathery. The fruit ripens in July. It is almost globular, being about 1 in. long and ¾ in. broad. It is densely covered with small elevations, and contains a single seed-stone of light weight. There are 2 varieties

of the fruit, the light rose-colored one being finer flavored than the dark red. The berries are vinous and sweet and used in all ways like our blackberries. The tree is supposed to be able to stand 15° above zero.

Myrica is a genus of about 35 species of trees and shrubs, often aromatic: lvs. alternate, entire, or variously

1450. Myrica Nagi in flower (×¼).
Natural size of the edible fruits is about an inch.

cut: male fls. borne in short catkins on the new growth; stamens 2–16, usually 4–6; female fls. mostly solitary: drupe globose or ovoid.

Nági, Thunb. (*M. rùbra*, Sieb. & Zucc.). Fig. 1450. Bush or tree: lvs. 3–5 in. long, oblong-lanceolate, tapering at the base, entire or serrate: male catkins axillary, solitary, cylindrical, ½–1½ in. long; stamens 6–10; female catkins shorter than the male, few-fld. Tropical and subtropical Asia. B.M. 5727.

M. asplenifòlia. See Comptonia. W. M.

MYRIOCÉPHALUS (Greek, *ten-thousand-headed*). *Compósitæ. M. Stuartii* is an odd sort of everlasting flower, known to the trade as *Polycalymma Stuartii*, being offered in only one of the largest American catalogues of annual fls. It is a half-hardy plant, growing about 1¼ ft. high and bearing yellow and white heads. Myriocephalus is a genus of about 8 annual or perennial herbs, all Australian, often hoary, especially when young: lvs. alternate, entire: clusters or compound heads terminal, usually globose or hemispherical: heads exceedingly numerous and sessile on a broad, very flat receptacle, surrounded by a general involucre of numerous narrow bracts in many rows, each usually with a scarious tip or radiating appendage. In *M. Stuartii* these appendages are 1–2 lines long, broad, white and very conspicuous. Flora Australiensis 3: 557 (1866).

Stùartii, Benth. (*Polycalýmma Stùartii*, F. Muell. & Sond.). Pubescent or woolly, not much branched: lvs. linear or lanceolate, 1–2 in. long: clusters hemispherical, 1 in. or more across: partial heads 5–8-fld.: seeds woolly; pappus of numerous ciliate bristles.

MYRIOPHÝLLUM (Greek, *ten-thousand-leaved*). *Haloragàceæ.* The Parrot's Feather is a favorite aquatic plant, with delicate feathery foliage, composed of numerous whorls of finely cut lvs. The one which is often seen in vases and fountains in public parks has the uncomfortable name of *Myriophyllum proserpinacoides.* It is a half-hardy plant from Chile, with weak stems which grow out of the water about 6 inches. It can be planted in a water-tight hanging basket, and if water can be kept standing on the surface, the plant will hang gracefully over the edges. The other species here described are hardy plants, which are common in our eastern ponds. Any one of them can be gathered for the aquarium, and the two following are procurable from dealers in aquatics and aquarium supplies.

Myriophyllum is a genus of about 15 species of aquatic herbs, found from the frigid zones to the tropics. Lvs. whorled, somewhat scattered or alternate, the emersed ones entire, dentate or pectinate, the submerged ones pinnately cut into thread-like segments: fls. small.

A. *Lvs. all alike.*

proserpinacoides, Gill. Fig. 1451. Lvs. in whorls of 4 and 5, 7–10 lines long: segments 20–25. Chile. Apparently established in Hopkins' pond, Haddonfield, N. J., having escaped from cult. B.B. 2:505.—Differs from the 2 following in being diœcious. The female plant is the one in cult. Likely to become weeds.

AA. *Lvs. above the surface of the water different from those below.*

B. *Lvs. whorled in 3's and 4's.*

verticillàtum, Linn. Floral lvs. longer than the fls., pectinate: stamens 8: petals deciduous: carpels even. Native of Europe, but common in our ponds.

BB. *Lvs. whorled in 4's and 5's.*

heterophýllum, Michx. Floral lvs. ovate, lanceolate, sharply serrate: stamens 4: petals rather persistent: carpels 1–2-ridged and roughened on the back. Lakes and rivers. Ont. to Fla. and Minn.

Wm. Tricker and W. M.

MYRÍSTICA (Greek, alluding to the aromatic qualities of the plants). *Myristicàceæ.* Nutmeg. Myristicas are of many species (perhaps 80), but most of the Nutmegs of commerce are the product of **M. frágrans,** Houtt. (*M. moschàta,* Thunb.; *M. officinàlis,* Linn. f.; *M. aromàtica,* Lam.), shown in Figs. 1452–3. This tree is cultivated and naturalized in the W. Indies. The genus Myristica is the only one in the family. It is essentially an Asian genus, although species occur in America and Africa, and one in Australia. The Myristicas are diœcious trees with alternate, entire, pinnate-veined lvs., and small fls. in axillary clusters. The perianth is 2–4- (usually 3-) lobed, in a single series: anthers 3 or more, connate: ovary single, 1-loculed, ripening into a fleshy fruit. The Nutmeg of commerce is the seed. This is surrounded by a ruminated aril, which furnishes the

1451. Myriophyllum proserpinacoides (×¼).

mace of commerce. The fruit of *M. frugrans* is short pear-shaped, 1½–2 in. long, hanging, reddish or yellowish, somewhat fleshy, splitting at maturity into 2 valves and disclosing the brilliant scarlet laciniated aril or mace. Inside the aril is the hard nut or shell, and inside the shell is the Nutmeg. The details of the mace

and Nutmeg are shown in Fig. 1453. For a full illustrated and historical account of the Nutmeg, see B.M. 2756–7 (1827). L. H. B.

The Nutmeg tree requires a position in well-sheltered, hot, moist valleys in the tropics from sea-level up to 400 or 500 feet; it will grow and produce fruit in Ja-

1452. **Myristica fragrans—the Nutmeg** (×¼).
The upper sprays are from the staminate tree.

maica up to 2,000 feet, but the fruit is not so abundant nor the nut so large as at lower elevations. The soil must be a deep, rich loam, well drained. The seedlings have a tap-root which is very easily injured in transplanting. The method usually adopted for growing them is to sow the seeds in bamboo pots, one in each. When they are ready for planting in their permanent places, the bamboo is slit, and the soil, with the plant, gently put into the prepared hole. It is only when they first flower that it is possible to tell the sex of the tree. Nothing is known of the conditions which determine the sex. In Grenada, the usual proportion of male trees to female is said to be as 3 to 1, though sometimes 40 or 50 trees close together will all be either male or female. As the trees generally flower when they are 6 or 7 years old, there is great waste in the growth of male trees. In the Botanic Gardens in Jamaica, it has been found possible to graft the Nutmeg, so that a loss of this kind should not occur again; the plan is, take young seedlings and graft, by approach, the thinnest twigs of a female tree. Wm. Fawcett.

MYRRHIS (from the Greek word for perfume). *Umbelliferæ*. Myrrh. Sweet Cicely. One perennial herb native to Europe, and an immigrant to other countries, sometimes grown in gardens for its pleasing scent and anciently used as a flavoring in salads. In America Myrrhis is represented by Osmorhiza, which is known as Sweet Cicely. Two or three of the American plants have been named under Myrrhis, but Coulter and Rose (Revision N. Amer. Umbelliferæ, 1888) contrast the two genera and refer these species to Osmorhiza. Technical characters distinguish the two genera.

The Myrrh of the Arabs is the gum of *Balsamodendron Myrrha*, a burseraceous tree which is now referred (Engler in DC. Monogr. Phaner. 4) to Commiphora.

odoràta, Seop. Myrrh. Soft-hairy or pubescent, erect, 2–3 ft.: lvs. thin and soft, 2–3-pinnate, with narrow-toothed or pinnatifid segments: fls. small, whitish, in a compound umbel which is devoid of a general involucre: fr. ½ in. long, longitudinally ribbed. Eu.—Herbage sweet-scented. Rarely seen in this country. L. H. B.

MYRSÌNE (an old Greek name for the Myrtle, of no application; the Myrtle is *Myrtus communis*). *Myrsinàceæ*. About 80 widely scattered species of shrubs or trees, of which *M. floribunda* has been offered in Fla., but is probably no longer cult. Glabrous or tomentose: lvs. leathery, mostly entire: fls. small, sessile or pedunculed, in axillary clusters, polygamo-dioecious; floral parts in 4–5's: fr. a pea-shaped drupe, dry or fleshy, 1-stoned: seed globose.

floribùnda, R. Br. (*M. Rapànea*, Roem. & Schult. *A. Floridàna*, A. DC.). Glabrous: lvs. 3–4 in. long, leathery, obovate, rounded or notched at top, revolute at margin, rusty and dotted beneath, devoid of pellucid dots: clusters of fls. peduncled: corolla imbricated. S. Fla. to Urnguay.

MYRSIPHÝLLUM. Consult *Asparagus*.

MYRTLE. *Myrtus communis*. **Crape M.** *Lagerstrœmia*. **Running M.** *Vinca minor* and others. **Sand M.** *Leiophyllum*.

MŸRTUS (*Myrtos*, the ancient Greek name). *Myrtàceæ*. Myrtle. Mostly shrubs: lvs. opposite, entire, penni-veined, usually aromatic: fls. white or rose-tinged, axillary, 1 to many, the central on short, lateral or long pedicels; calyx tube turbinate, 5- (rarely 4-) lobed, usually persistent; petals 5 (rarely 4); stamens numerous, in several rows, free: ovule 2–3-celled: fr. a berry, adnate to, or included in the calyx-tube. A genus of perhaps 100 species, mostly subtropical natives of S. America and Australia.

Myrtles are grown in pots for greenhouse, window or room decorations, or, in Calif. and the South, as outdoor ornamental shrubs. They are easily cultivated and readily propagated from firm or partially ripened cuttings. They like an abundance of water in summer, and should never be allowed to get quite dry at the roots.

communis, Linn. The classic Myrtle. A handsome shrub, 3–10 ft. high, both fls. and lvs. strongly scented: lvs. small in the variety usually cultivated: peduncles solitary, 1-fld., about the length of the lvs., bearing 2 linear bractlets below the fls.: berry black. July. S. Eu. — Several varieties are cult., which differ chiefly in the shape and size of the lvs.; there is also a variegated form. Makes a good hedge in S. Fla. Everblooming in S. Calif.

1453. **Nutmegs** (×½).
The upper specimens show the aril or mace. The lower left specimen shows the nut after the mace is removed. The lower right specimen shows part of the shell removed, disclosing the nutmeg.

Lùma, Berneoud (*Eugènia apiculàta*, DC. *E. Luma*). Luma. Shrub, 3 ft. or higher: peduncles 3- to 5-branched: fls. larger than those of *M. communis*. S. Chile; hardy in S. Calif. and probably northward.

Ùgni, Molina (*Eugènia Ugni*). Ugni or Chilean Guava. As usually seen under cult., this is a shrub 4 ft. high, but in its native habitat it is said to become a tree 100 ft. high: pedicels 1-fld.: berry purple, glossy, edible, with a pleasant odor and taste. Wood very hard and heavy, much used in Chile for press-screws, wheel-spokes and select implements. Chile; hardy in S. Calif. B.M. 4626. R.H. 1879, p. 409.

M. tomentòsa, Soland.=Rhodomyrtus tomentosa.

J. Burtt Davy.

N

NABALUS. See *Prenanthes*.

NÆGÈLIA (Karl von Nægeli, late professor of botany at Munich). *Gesneràceæ*. About half a dozen tropical American herbs allied to Achimenes, but the fls. arranged alternately in a leafless terminal panicle (in Achimenes the fls. are axillary). Because of the panicled flowers, Nægelias are very ornamental plants. They are warmhouse subjects, propagating by stolons or offsets. In cultivation the plants are often called Gesnerias than Nægelias, but they are distinguished from that genus in usually having an annular or ring-like disk at the base of the corolla, rather than a deeply lobed disk. Tubers usually none. Nægelias hybridize with other Gesnerias. One hybrid race is known as Nægelio-Achimenes and another (F.S. 10:987–8) as Mandirola. L. H. B.

In general, the cultural methods given under *Gesneria* suit Nægelias well. The bulbs should be stored in the pots in which they have been grown. It is a bad plan to keep any bulbs or tubers of the Gesneriaceæ in dry sand in a dry store-room. After being well ripened, Nægelia bulbs should be kept in the greenhouse under the benches. Keep them out of the drip, but water them occasionally. T. D. Hatfield.

A. *Fls. nearly scarlet, or brick-red, marked with white.*

cinnabarina, Lind. (*Gesnèria cinnabarìna*, Lind.). Fine winter-blooming plant, 1½–2 ft. tall, soft-hairy: lvs. round-ovate and cordate, crenate-dentate, thickish, green, with red or purplish hairs: fls. about 1½ in. long, hanging on the ends of spreading pedicels, gibbous-tubular to the very base, the calyx-lobes acute and spreading, the short corolla-lobes unequal and obtuse, the flower cinnabar-red or nearly scarlet on the upper side, but paler and spotted on the under side. Mex. B.M. 5036. Lowe, 33.

AA. *Fls. orange-scarlet or scarlet, marked with yellow.*

zebrina, Regel (*Gesnèria zebrìna*, Paxt.). Fig. 1454. Much like the above, but brighter colored, red-dotted below, and yellow within and on the under side: calyx-lobes short and appressed: corolla contracted towards the base, whereas they are gibbous or swollen to the very base in *N. cinnabarina*. Brazil. B.M. 3940. B.R. 28:16. P.M. 271.—A fine plant, of which there are several forms. The commonest species. Names belonging here are *Gesneria regalis* and *G. splendens*.

achimenoides, Hort. Hybrid of *N. zebrina* and Achimenes or Gloxinia (said to be with *A. gloxiniiflora*): fls. very large (often 2 in. long), yellowish rose on the outside, yellow and rose-spotted on the inside, the segments clear rose.

AAA. *Fls. white, cream color or rose.*

amábilis, Decne. (*N. multiflòra*, Hook.). Fls. white or cream color, numerous, hanging, the tube curved and not much swollen, the obtuse lobes subequal: plant bearing long, glandular hairs in addition to the velvety covering: otherwise much like *N. zebrina*. Mex. B.M. 5083. F.S. 12:1192 (as *Achimenes* [*Nægelia*] *amabilis*). G.C. III. 22:413.—The tenable name of this species is usually held to be Hooker's *N. multiflora*, which dates from 1858; but Decaisne's *N. amabilis*, or *N. amabilis*, Hort., is older.

hyacinthina, Carr. Of horticultural origin, probably a hybrid: fls. white or rose, in a very compact pyramidal panicle. R.H. 1877:29.

N. fulgida, Ort. Fls. vermilion: lvs. large, oval, deeply toothed. Mex.—*N. Geroltiana*, Regel. Continuous-flowering plant, allied to N. zebrina. Mex. F.S. 2:pl. 4, for April.—*N. sceptre corail*, Carr. Fls. many in an open panicle, cinnabar-red, yellow-spotted inside. R.H. 1869, p. 154 and col. plate. For pictures of varieties and hybrids, see F.S. 16:1671–2: 10, 987–8. L. H. B.

NÆGELIO-ACHIMENES is a trade name mentioned under *Nægelia*.

NANDÍNA (Japanese name). *Berberidàceæ*. A small, tender shrub, with bright red or white berries, said to be cult. in every little garden in Japan. "At a distance, says Kæmpfer, it has a reed-like appearance, many simple stems springing up from the same root, which are branched toward the top only, and are terminated with a pyramidal panicle of red berries the size of a pea."—B.M. The stems are about as thick as a finger. The foliage is evergreen, and graceful at all times, being twice or thrice ternately cut. The young growth is prettily tinged with red, and the bases of the lower stalks are often swollen into red globular bodies The fls. are small, numerous, white and panicled

1454. Nægelia zebrina.
Generally known as a Gesneria.

This shrub is rarely grown North under glass. Pot-grown plants or seeds are procurable from Japanese dealers. The seeds are said to be of an uncommon shape, being convex on one side and concave on the other.

The genus contains but one species. It is the only erect-growing shrub in the barberry family outside of Berberis. It agrees with the common barberries in having 6 stamens and an indehiscent berry, but the fls. are differently

1455. Narcissi.
a a, N. Pseudo-Narcissus; *b*, N. Jonquilla; *c*, N. poeticus.

colored and the sepals more numerous. There are about 6 petals, but the numerous sepals gradually pass into petals, the outer ones being small, green and leathery, the inner larger and whiter. Ovules 2, ascending from the base.

doméstica, Thunb. Described above. Lfts. entire. Japan and China. B.M. 1109. Gn. 23, p. 329; 58, p. 13.
W. M.

Nandina domestica is an old favorite in S. Calif., and many fair-sized specimens may be seen, though 8 ft. high is the largest the writer can call to mind now. Of late years the sale of Nandina has been very slight, as it is not very desirable, except for its general effect as a shrub, and it takes some years to make a show. Many faster growers and better bloomers have taken its place. It does not produce sufficient foliage; the stem is always bare, leaving an indistinct whorl of lvs. at the extreme top. The fls. are inconspicuous. It is of easy culture, and does best in a position shaded from the sun during the hotter part of the day. It stools very freely, and for this reason is somewhat used in shrubberies, where its otherwise naked stems would render it valueless. ERNEST BRAUNTON.

NAPOLEÒNA (after Napoleon Bonaparte). *Myrtàceæ*. *Napoleona imperialis* is a truly imperial plant, and worthy of being named after the distinguished military leader. It is a tropical African tree, with flowers that at once suggest a royal crown. They look something like a gorgeous passion flower, with equally rich though different coloring, and the same simplicity and symmetry of design expressed in the same rich multiplicity of detail. They are shaped like a saucer, about 2 inches in diameter, and the dominant color is apricot. Inside the saucer are two crowns, one within the other, the inner one smaller. The rim of the saucer is broken up into about 35 blunt teeth, all regular and formal, each one with a plait running down the back to the center of the saucer, and each tooth minutely serrate around its margin. In the bottom of the saucer is a circular fringe of green threads, all of equal length and fineness, springing from the base of the larger crown. This fringe is displayed against a rich, dark red background, which imitates in outline the toothed rim of the saucer, and colors perhaps three-fourths of the bottom of the saucer. In the Flora of Tropical Africa the fls. are said to be red, white or blue. Elsewhere it is stated that the fls. turn bluish as they decay. This interesting tree seems never to have been offered in America, but is probably procurable from Europe. B.M. 4387. G.C. 1844:780. R.H. 1853, p. 301.

NARCÍSSUS (old name, thought by some to be derived from the story of the youth Narcissus, and by others from the Greek word for narcotic, in allusion to the narcotic-poisonous properties of the plant). *Amaryllidàceæ*. Plate XX. Figs. 1455–1462. Narcissi are amongst the choicest of hardy spring-flowering plants. They have long been favorites. In recent years some of the species have come into prominence as subjects for winter forcing. Baker, in his Handbook of the Amaryllideæ, 1888, reduces the species to 16, but garden authors usually recognize thrice that many. They are mostly native to southwestern Europe and the Mediterranean region. The peculiar characteristic of the Narcissi is the conspicuous crown or short tube in the throat of the corolla, with which the stamens are not united. The flowers (Fig. 1456) have 6 spreading segments, 3 of which are exterior; stamens 6, attached to the corolla-tube; fls. single or several from a dry spathe, usually standing at an angle on the pedicels: bulbs tunicated, the outer scales dark-colored: fr. a thin dehiscing capsule, containing nearly globular or angular seeds: lvs. linear or even awl-like, appearing with the flowers. Narcissi are spring-blooming bulbs, most of them perfectly hardy in the northern states and capable of being naturalized in cool and grassy places. Some of the species are popular bulbs for winter forcing. The genus includes the Daffodils (Daffy-down-dillies) and Jonquils. There are autumn-flowering species, but they are little known to cultivators. These autumn bloomers are of 3 species: *N. viridiflorus*, Schousb., fls. green throughout, lvs. nearly terete and usually not appearing with the fls.; *N. serotinus*, Linn., pure white with yellow corona, the lvs. nearly terete and appearing after the fls.; *N. elegans*, Spach, greenish white with yellow corona, the lvs. appearing with the fls. Many of the garden Narcissi are hybrids. Some students suppose that some of the rec-

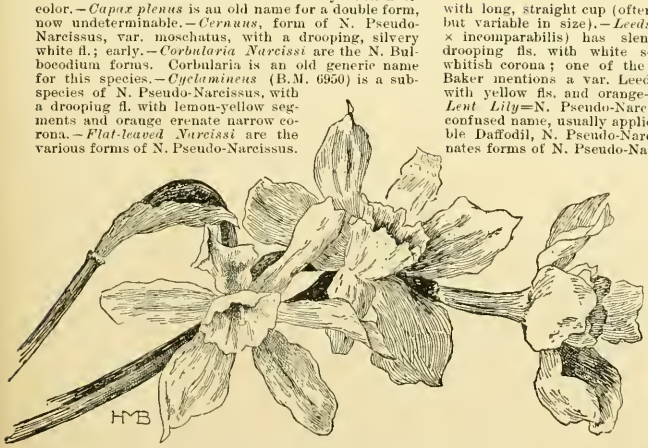
1456. Narcissus incomparabilis.
Corona shorter than usual. *a* shows the corona; *c*, the ovary; *b*, the spathe. Natural size.

ognized species (as *N. incomparabilis* and *N. odorus*) are hybrids. See Engleheart, Journ. Roy. Hort. Soc. 17, p. 35.

The word Daffodil is variously used. In this country it means usually the full double forms of *N. Pseudo-Narcissus*, plants which are very common in old gardens. Modern named varieties of this Daffodil type are Van Sion and Rip Van Winkle. In England, however, Daffodil is a more general term, used for most species except the Poet's Narcissus (*N. poeticus*).

There are numberless forms of garden Narcissi. Some of these are hybrids and others are direct variations from the pure or original species. Many of these forms bear Latin names, as if they were species, and thereby confusion often arises. The most serviceable classification is based on the size and shape of the crown or corona. Baker recognizes three great sections, which are followed below. The standard works on the Narcissus in English are Burbidge's "The Narcissus," with many colored plates, and Peter Barr's "Ye Narcissus or Daffodyl Flowre, and hys Roots." Haworth wrote a Monograph of Narcissi in 1831, in which he made 16 genera of the plants which are now referred to Narcissus. For 300 years and more, some of the species have been known as cultivated plants. In the following account, the main or stem species are given; and the most common trade and class names are given in an introductory paragraph, with notes as to their botanical positions.

Following are the common and important Latin-form trade names (see the main list, below): *Albicans*, a form of N. Pseudo-Narcissus, var. moschatus, the segments white and the corona primrose, changing to white.—*Ajax* is an old generic name for N. Pseudo-Narcissus; this species is now sometimes called the Ajax Narcissus.—*Backhousei* (Pseudo-Narcissus × incomparabilis) has single horizontal yellow flowers with tube nearly equaling the segments.—*Barrii* (poeticus × Pseudo-Narcissus or incomparabilis × poeticus), of the medium-crowned section, has yellow horizontal fls. with long, slender neck; "covers a series of forms intermediate between incomparabilis and poeticus, nearer the former than the latter" (Baker); Fig. 1457.—*Bernardi* is like N. Macleaii, but with a more plicate and deeper-colored corona.—*Bunch-flowered Daffodils* are N. Tazetta.—*Burbidgei* (probably incomparabilis × poeticus, in a series of forms) has the habit of N. poeticus, with a solitary drooping flower with white segments and a very short corona with a yellow base and red rim.—*Cambricus* is an early whitish bicolor.—*Capax plenus* is an old name for a double form, now undeterminable.—*Cernuus*, form of N. Pseudo-Narcissus, var. moschatus, with a drooping, silvery white fl.; early.—*Corbularia Narcissi* are the N. Bulbocodium forms. Corbularia is an old generic name for this species.—*Cyclamineus* (B.M. 6950) is a subspecies of N. Pseudo-Narcissus, with a drooping fl. with lemon-yellow segments and orange crenate narrow corona.—*Flat-leaved Narcissi* are the various forms of N. Pseudo-Narcissus.



1457. Narcissus Barrii. One of the popular hybrids.

—*Ganymedes* is an old generic name for N. triandrus and its forms.—*Giganteus* = Sir Watkin.—*Graellsii* is a form of N. Bulbocodium with small cream-white fls. B.M. 6473 B.—*Grandiflorus* is applied to a large-fld. white form of N. Tazetta.—*Humei* (incomparabilis × Pseudo-Narcissus) has a single nodding yellow flower with long, straight cup (often equaling the segments, but variable in size).—*Leedsii* (probably poculiformis × incomparabilis) has slender-tubed horizontal or drooping fls. with white segments and yellow to whitish corona; one of the medium-crowned kinds; Baker mentions a var. Leedsii of N. incomparabilis with yellow fls. and orange-red rim to the corona.—*Lent Lily*=N. Pseudo-Narcissus.—*Lobularius* is a confused name, usually applied to the deep yellow double Daffodil, N. Pseudo-Narcissus.—*Lorifolius* designates forms of N. Pseudo-Narcissus.—*Lusitanicus* is a name for a bicolor N. Pseudo-Narcissus.—*Macleaii* (probably Pseudo-Narcissus × Tazetta) is a 1- to 2-fld. plant of stout growth, bearing horizontal short-tubed fls. with white segments and yellow crenate corona half or more the length of the lobes. B.M. 2588. B.R. 12:987.—*Major* (N. major, Curt; B.M. 51) is a form of N. Pseudo-Narcissus, very robust, with deep golden yellow flower.—*Mastersianus* is a hybrid of N. Tazetta and N. poculiformis.—*Maximus* is a large-fld. form of N Pseudo-Narcissus with

1458. Single Trumpet Daffodil—N. Pseudo-Narcissus. (× ¼.)

yellow fls.—*Milneri*, hybrid of N. incomparabilis and N. Pseudo-Narcissus, var.moschatus.—*Minor* (N. minor, Linn.) is a very dwarf form of N. Pseudo-Narcissus (6 in. or less high),with sulfur-yellow segments and deeper yellow corona.—*Montanus* = poculiformis.—*Muticus* (Ajax muticus, Gay) is a form of N. Pseudo-Narcissus with narrow yellow corona and sulfur-yellow segments.—*Nelsoni*, a subtype of N. Macleaii, very robust, and fls. larger (2–3 in. across), the corona more than half as long as the segments.—*Obrallaris* is a dwarf form of N. Pseudo-Narcissus, with floriferous habit, bright yellow fls. and rather short segments.—*Ornatus* is an early form of N. poeticus.—*Pullidus*, a white form of N. Pseudo-Narcissus.—*Peerless Narcissi* are the forms of N. incomparabilis.—*Poculiformis* (or N. montanus, Ker; B.R. 2:123) has 1 or 2 nodding white fls. and a straight corona about half the length of the segments; origin doubtful: by some regarded as a hybrid and by others as a native of the Pyrenees. *Princeps*, sulfur-yellow and yellow-crowned, a form of the N. Pseudo-Narcissus type.—*Queltia* is an old generic name to distinguish the group comprising N. incomparabilis.—*Rip Van Winkle* is a double variety of N. Pseudo-Narcissus.—*Roman Narcissus* is a name for double-fld. N. Tazetta, white with orange cup.—*Rugilobus*, large-fld. pale yellow variety of N. Pseudo-Narcissus.—*Scoticus*, N. Pseudo-Narcissus with deep yellow corona and whitish segments; known as Scotch Garland Lily.—*Sir Watkin* or *giganteus* is a very large-fld. form of N. incomparabilis.—*Spurius*, a yellow N. Pseudo-Narcissus, a subform of var. major.—*Telamonius*, a yellow N. Pseudo-Narcissus, usually known as Van Sion.—*Telamonius plenus* is a double form.—*Tenuior* is a slender form of N. gracilis, the small pale fls. changing to white. B.M. 379.—*Tortuosus* has twisted segments: a form of N. Pseudo-Narcissus, var. moschatus.—*Tridymus* is like N. Nelsoni, but has 2–3 fls., with tube usually obconic.—*Van Sion* is a large pure yellow and very double form of N. Pseudo-Narcissus, much used for forcing. There is also a single Van Sion.—*Variiformis* is a form of N. Pseudo-Narcissus with canary-yellow corona and white segments, the fls. variable.

1459. Paper White Narcissus—N. Tazetta, var. alba (× ⅔).

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Jonquilla, 10.
juncifolius, 6.
lacticolor, 7a.
Lent Lily, 2.
lutcus, 7c.
monophyllus, 1.
moschatus, 2.
ochrolencus, 7a.
odorus, 5.
orientalis, 7a.
pachybolbos, 7b.
Panizzianus, 7b.
Paper White, 7b.
papyraceus, 7b.
patulus, 7a.
Pheasant's Eye, 12.
poeticus, 12.
polyanthus, 7b.
Polyanthus Narcissus, 7.
Primrose Peerless, 11.
Pseudo-Narcissus, 2.
radiiflorus, 12.
Tazetta, 7.
triandrus, 3.
Trumpet Daffodil, 2.

A. MAGNICORONATI *or* LARGE-CROWNED *species: corona as long as the segments, or even longer, trumpet-shaped or cylindrical.*—DAFFODILS. (Forms of No. 3 may be sought here.)

B. *Lvs. green, few (often only 1), very slender and nearly terete, channelled.*

1. **Bulbocòdium,** Linn. HOOP-PETTICOAT DAFFODIL. A slender plant, with bulb 1 in. or less in diam., and the very slender lvs. (usually 3 or 4 to each stem) mostly overtopping the blossoms: fl. 1, ascending or horizontal (not declined), 1½ or 1¾ in. long in most forms, normally bright yellow in all parts, the very prominent thin corona entire or crenulate; stamens inserted near the base of the tube, declined, rather long. S. France to Morocco. B.M. 88.—Runs into many garden forms and hybrids. Fls. usually borne 5–8 in. above the ground.

Var. **monophýllus,** Baker (*N. monophýllus*, Moore. *N. Clusii*, Dunal). An Algerian form, now in cult., usually with 1 lf., and fl. sessile and white: corona crenate. B.M. 5831.

Var. **citrinus,** Baker. Fls. large, pale lemon-yellow, the corona crenulate.

BB. *Lvs. glaucous, several, flat.*

2. **Pseùdo-Narcissus,** Linn. COMMON DAFFODIL. TRUMPET DAFFODIL. LENT LILY. Fig. 1458. Strong plant, 12–18 in. tall, with bulb 1½–2 in. in diam.: lvs. narrow but flat, erect, usually about reaching the blossoms; fl. about 2 in. long, horizontal or ascending, pale yellow, the segments and corona usually of different shades, the corona deeply crenate or almost crenate-fimbriate, more or less plicate; stamens inserted near the base of the perianth, short. From Sweden and England to Spain and Austria.—Exceedingly variable in size, shape and coloring of fls. There are full double forms (Common Daffodil) in which the corona disappears as a separate body, and supernumerary segments are present. It is one of the hardiest and commonest of Narcissi.

This species is the Trumpet Narcissus, so named from the long corona. The normal forms are Yellow Trumpets, but the Bicolor Trumpet, var. **bicolor,** Hort. (*N. bicolor*, Linn.), has pure white segments and yellow corona. To this variety Baker refers *N. brevifloss*, Haw. (B.M. 1187), and *N. Hórsfieldii*, Burb. The White Trumpets are var. **moschàtus,** Hort. (*N. moschàtus*, Linn.; B.M. 1300), which has cream-white or white flowers.

AA. MEDIOCORONATI *or* MEDIUM-CROWNED *species: corona usually about half the length of the segments, cup-shaped.* (Forms of N. triandrus may have large crowns.)

B. *Segments narrow, standing straight backwards (reflexed).*

3. **triándrus,** Linn. CYCLAMEN-FLOWERED NARCISSUS. Slender (scape 10–18 in. tall), bulb ¾ in. or less in

1460. The Jonquil—Narcissus Jonquilla (× ⅓).

diam., the lvs. few, very slender and semi-cylindrical and not overtopping the blossoms: fls. 1–several, horizontal or drooping, an inch long, both the lanceolate segments and the entire cup-shaped corona pure white in the type; stamens sometmes a little exserted. Spain and Portugal.

Var. **calathìnus** (*N. calathìnus,* Red., Burbidge, etc., not Ker-Gawl). Corona larger, nearly or quite as long as the segments, the flower pale yellow. Island of Brittany.

BB. *Segments oblong or broader, spreading.*

C. *Lvs. flat (but narrow) and glaucous.*

4. **incomparábilis,** Mill. Figs. 1456. Strong fine species, with large bulb (1½ in. in diam.) and 3–5 lvs., which are nearly or quite the length (1 ft. long) of the distinctly 2-edged scape: fl. always one, not fragrant, horizontal or somewhat ascending, on a very short pedicel, the tube usually greenish, the segments and cernate-plicate corona pale yellow in the type (but varying to other color combinations), the stamens not exserted. S. France and Spain to the Tyrol. B.M. 121.—One of the commonest species in cult., the fls. often 3–4 in. across. Double forms are frequent. Var. **álbus,** Hort., has white fls., with the corona usually pale yellowish. Var. **auránti**s, Hort., has the corona orange at the top.

C. *Lvs. linear and channelled, green.*

5. **odòrus,** Linn. Lvs. half the width (¼ in.) of those of *N. incomparabilis,* the bulb nearly or quite as large, the peduncle terete or very nearly so: fls. about 2 (sometimes 4), fragrant, the tube more slender than in *N. incomparabilis,* and the corona somewhat smaller, the fl. bright yellow throughout. France and Spain and eastward. B.M. 934 (as *N. calathinus*).—A good hardy species, differing from *N. incomparabilis* chiefly in its narrow leaves, 2 or more blossoms to a peduncle, fls. fragrant.

6. **juncifólius,** Lag. Small, slender species, with bulb about ½ in. in diam., and very narrow, rush-like lvs., about 6 in. long and about equaling the terete scape: fls. 1–4, horizontal or ascending, the tube slender-cylindrical (½ in. long), the broad-ovate, spreading segments and the cup-shaped, crenulate corona bright yellow. S. France and south.—A choice fancier's plant.

AAA. PARVICORONATI *or* SMALL-CROWNED *species: corona usually much less than half the length of the segments, mostly saucer-shaped.*

B. *Corona soft and uniform in texture: lvs. various.*

C. *Lvs. ½ in. or more broad, flat, somewhat glaucous.*

7. **Tazétta,** Linn. POLYANTHUS NARCISSUS. Fig. 1459. Strong species, the bulb often 2 in. in diam., the lvs. 1½ ft. or less long, about the length of the flattened peduncle: fls. several (4–12), horizontal or declined on slender pedicels, the tube less than 1 in. long and greenish, the spreading, broad segments pure white, and entire corona lemon-yellow, the whole fl. about 1½ in. across. Canary Isl. to China and Japan.—The commonest species and the most variable. "Of the multiform Tazetta Narcissi about 100 have received specific names."—*Baker.* "The numerous forms of *N. Tazetta* are so extremely variable that nothing short of fifty folio plates would do the plant justice."—*Burbidge.* All this mass of varieties is readily grouped under one specific type, however, which is recognizable by the many small-crowned fls. and the broad lvs. The variations are largely in color and in size of fls. Baker makes three groups:

a. *bicolores,* the perianth white and the corona yellow. Here are to be placed *tacticolor, Corcyrensis, patulus, ochroleucus* and many others. It is probable that the "Chinese Sacred Lily" (*N. orientalis,* Linn. B.M. 948) is a form of this subtype, although Baker suggests that it is *N. incomparabilis* × *Tazetta.* It is known as Tazetta, var. **orientàlis,** Hort.

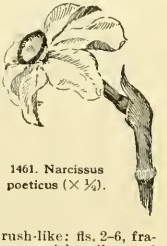
b. *albæ,* entire fl. white. Here belongs the "Paper White," very popular for winter bloom. Here are to be referred the names *papyraceus, Panizzianus, dubius, Canariensis, pachybolbos, polyanthos.*

c. *luteæ,* entire fl. yellow. Here belong *aureus, cupularis, Bertolonii, Italicus.*

CC. *Lvs. ¼ in. or less broad, mostly terete or subterete, not glaucous.*

8. **intermèdius,** Lois. A yellow-fld. species, distinguished from *N. Tazetta* chiefly by its subterete, deep-channeled green lvs., which are only ¼ in. wide: peduncle nearly terete. S. France and Spain.

9. **grácilis,** Sabine. Smaller, 1 ft. high, the peduncle 2-edged, the bright green lvs. ⅛ in. or less wide and very convex on the back: fl. pale yellow, the corona usually somewhat deeper colored than the segments. S. France (?). Known chiefly as an old garden plant. B.R. 10: 816.



1461. Narcissus poeticus (× ⅓).

10. **Jonquilla,** Linn. JONQUIL. Fig. 1460. Very slender and graceful plant, 1½ ft. or less tall, the lvs. and peduncle about equal in height, the lvs. glossy dark green and very narrow and rush-like: fls. 2–6, fragrant, the slender cylindrical tube greenish yellow and an inch or less long, the segments yellow, obovate and scarcely overlapping, the corona very short (¼ in. or less long), crenate, the same color as the segments. S. Eu. and Algeria. B.M. 15.—One of the old-fashioned fls., perfectly hardy in N. Y

BB. *Corona with a prominently hardened or dry rim: lvs. broad.*

11. **hiflòrus,** Curt. PRIMROSE PEERLESS. Strong species, with bulb 2 in or less in diam.: lvs. 1–2 ft. long and nearly or quite ½ in. broad, and slightly glaucous, usually equaling and sometimes exceeding the

stout 2-edged peduncle: fls. 1–3, usually 2, white, with a pale yellow cup, the tube greenish white and 1 in. long, the segments broad-obovate and overlapping, the corona ⅛ in. long, with a crisped edge. Var. **álbus** has white fls. S. Eu. B.M. 197.—This plant has a wide range in the wild state, but some persons regard it as a hybrid of *N. Tazetta* and *N. poeticus*. Apparently little known in this country.

12. **poéticus,** Linn. PHEASANT'S EYE. Figs. 1461, 1462. Strong-growing species, sometimes 1½ ft. high, the bulb about 1 in. thick, the lvs. equaling or exceeding the 2-edged peduncle and ½ in. broad, somewhat glaucous:

1462. Double White Narcissus—N. alba plena odorata, a form of N. poeticus (×⅓).

fl. solitary (rarely 2), fragrant, wide open, the obovate overlapping segments white, the very short, yellowish corona much crisped and red-edged. Mediterranean region.—An old favorite, recognized by the red-margined, short corona. A double form of this (Fig. 1462) is a pure white, a rare color amongst double narcissi.

Var. **radiiflòrus,** Burbidge (*N. radiiflòrus,* Salisb.). More slender and lvs. narrower: corona narrower and more erect: segments narrowed below so that they do not overlap. L. H. B.

Culture of the Narcissus.—Narcissi are among the oldest of cultivated plants, but were much neglected for many years. During the last two decades there has spread a renewed interest in the family, with the usual result in such cases that the habitats have been closely searched for new forms, and new hybrids have been raised till we have now a surprising number of beautiful flowers available. Recently many of these have become so plentiful that they are within reach of the most impecunious gardener, and there is no reason why American gardens should not be filled with good collections of these beautiful flowers, or why florists should not force a more interesting list. With few exceptions the Narcissi are hardy and strong-growing under ordinary cultivation. The "bunch-flowered" or Polyanthus Narcissi and Corbularias are better grown under glass. The Moschatus varieties, which are white (or properly sulfur-white) forms, seem to be of rather tender constitutions in most gardens. Otherwise the Narcissi as a rule succeed in good turfy loam, but no manure, rotted or otherwise, must touch the bulbs. Of course drainage should be good, and moisture plentiful in growing season. In the garden it is well to plant the bulbs say 6 or 8 inches deep, and 3 inches at most apart, and allow them to remain till they form strong groups, or till they show signs of too much exhaustion from numerous offsets. As decaying foliage is unsightly in the garden, a good plan is to dress the beds in the fall with some rich manure, either animal or chemical, and in early spring start seedlings of annuals to cover the beds when the Narcissi are through flowering, the dressing being necessary for the sustenance of the double crop. Too strong a cultivation of the Narcissi is not to be recommended, an extra vigor of growth being detrimental to the purity of the color of the flowers. If the object is to increase one's stock as quickly as possible, biennial or even annual lifting and separation of bulbs is advantageous. For naturalizing in waste places, in the grass, or near water, many of the strong-growing kinds will succeed perfectly. What to select is somewhat experimental for, as every gardener knows, plants equally hardy and vigorous will not grow in every garden.

The proper time to plant is in late summer or early fall, and the Poeticus kinds should not be kept out of ground longer than possible; knob-like excrescences at the base of the bulbs indicate that growth is commencing and that planting should not be delayed. All Daffodils force easily after being well rooted, and should be brought on in a moderate temperature, as they are naturally low temperature plants—so much so, in fact, that in the open the flowers are very apt to be ruined under our sunny skies, especially if exposed to drying winds. A most satisfactory planting of Narcissi for house decoration is the use of flat lily pots, say 8 inches in diameter, placing the bulbs closely together. The flowers carry best and keep better if cut when half open.

The intending collector will perhaps be confused when he opens a list of say 200 varieties, and it may be as well to say that a moderate commencement may be made by selecting a few of each section into which these are usually divided in good lists, bearing in mind that price is not an indication of the beauty or usefulness. As a matter of fact, the lower price is usually an indication that these are not uncertain and are probably more valuable in the garden. There are a few forms, such as *N. Horsfieldii,* Emperor Maximus, Mrs. J. B. M. Camm, Stella, and all forms of Poeticus, which no well-constituted garden should be without, but one can scarcely go amiss. J. N. GERARD.

In Europe, the Narcissus, next to the tulip, is the most extensively grown and popular of the spring-flowering bulbs for outdoor culture. Probably owing to many varieties not proving hardy in our climate of extremes of temperature, it has never occupied the position it deserves in American gardens. Though many varieties are not hardy here, there are enough that can be successfully grown to make them among the most desirable of our spring-flowering bulbs. Though our hot suns ripen them much faster than in the equable climate of Britain, still a good selection of varieties will produce a greater profusion of bloom for a season of five weeks than any of our bulbous plants.

Most varieties are very accommodating in the matter of soil, succeeding well in any good garden that is not very sandy or a stiff clay, but good drainage is always essential. As they can occupy the same place for five or six years, it is well to prepare the bed by deep digging and liberal fertilizing with well-rotted stable manure. The bulbs should be planted from 4 to 5 inches deep from the upper end of the bulbs to the surface,

and from 4 to 6 inches apart. Those that increase slowly, as the Trumpet varieties, should be 4 inches, and the more vigorous Poeticus and Incomparabilis sorts should be at least 6 inches apart, as they increase so rapidly that in five or six years they will occupy the whole space. No variety should be disturbed till the bulbs are so crowded that they force themselves to the surface.

In the northern states and Canada plant in September, as soon as the bulbs arrive from Europe, or during the month of October, not later; after the end of October the bulbs cannot make roots enough before winter to produce good flowers the following spring. As soon as the surface of the soil is frozen, cover with strawy stable manure 4 to 6 inches deep, which should be raked off and removed as early in the spring as possible. After flowering, the foliage should be allowed to die naturally each spring; if cut off when green the bulbs do not ripen properly, and the flowers next season are inferior in quality; no seed pods should be allowed to form. When cutting for house decoration, cut as soon as the flower bud opens; the flowers last much longer than if exposed to the sun after opening. If specimens are to be mailed to a friend, cut before the bud opens; they will travel much safer, and will open out perfectly when put into water.

All the Poeticus varieties are perfectly hardy, and profuse bloomers, except *Alba plena odorata*, which cannot stand the hot suns of our average climate, and which blooms freely only in a cool, wet season. Most years the flowers are formed, but the spathe does not open. *N. poeticus*, with white perianth and reddish purple crown, is the sweetest perfumed and freest bloomer of all Narcissi, and should be in every garden. Its season is the last half of May. *Poeticus ornatus*, not so sweet perfumed, but a larger and showier flower, has a perianth of the purest white and an orange crown, in bloom the first half of May. Another very handsome form is *biflorus*, white, with pale yellow crown, flowers always in pairs, season about the same. The type *Burbidgei* and its numerous varieties are all desirable, but the above three kinds are the best of the short-crowned section.

The medium-crowned Narcissi, including *N. incomparabilis* and the hybrids *Barri*, *Leedsi*, *Humei*, *Nelsoni*, etc., is the largest of the three sections, many dealers offering over one hundred varieties. They are all, with the possible exception of *N. Humei* varieties, quite hardy and very desirable garden flowers, many of them increasing as rapidly as *N. poeticus*. The prevailing color is yellow in varying shades; sometimes the perianth is white, though never so pure a color as *N. poeticus*. They vary in size from the dainty little *N. Leedsi elegans*, white, with a pale yellow crown, to the Giant Sir Watkin, golden yellow, with a darker crown, a magnificent flower that should be in every collection. Other very satisfactory sorts are Stella, Cynosure, Sunray, Circe and Golden Gem. The best doubles in this section are double Incomparabilis, a very free bloomer, and Sulphur Phœnix, the most beautiful of all double Narcissi.

The large-crowned or Trumpet Narcissi are the most elegant and beautiful of all spring flowers. Unfortunately they have not the vigor or adaptability of the other sections, and most of them die out after two or three years' struggling against the unfavorable conditions of our climate; but many of them are so low in price now that they are well worth a place in the border even if they have to be replanted every two or three years. They are divided into three groups: (1) Yellow-flowered, in which the perianth and trumpet are both yellow, though sometimes of different shades. In this group Obvallaris and Emperor (a large flower) are quite hardy, while Golden Spur, Henry Irving, Trumpet major, Trumpet maximus, Shirley Hibbard, Countess of Annesley and Von Sion, all splendid flowers, bloom well the first spring, indifferently the second, and generally die after the third year, except under very favorable conditions. (2) The Bicolor group, in which the perianth is white or pale primrose and the trumpet deep yellow; among the whites Horsfieldii, Grandis and Empress are quite hardy and very beautiful. The best of the primrose perianths is the well-known Princeps, so cheap that it should be largely planted in every garden for cut-flowers. *N. bicolor*, *Pseudo-Narcissus Scoticus* and Michael Foster are not quite hardy. (3) The white-flowered, in which both perianth and trumpet are white, though generally with a tinge of sulfur. None of this group are quite hardy. Most of them are too expensive to plant for one season's bloom, but *Moschatus*, *Moschatus albicans* and *Pallidus præcox* are low enough in price to be worth trying. The well-known double Von Sion, so extensively forced by florists, is not quite hardy in the Canadian garden. It blooms well the first year, and sometimes the second year, but in the third or fourth year it turns green in color and gradually dies out.

None of the Polyanthus Narcissus, Jonquils, or Hoop-Petticoat Daffodils (*N. Bulbocodium*) are hardy enough to be worth planting in the colder parts of the northern states or Canada, unless in very favorable locations.

Pot Culture. — All varieties of the Narcissus are suitable for pot culture. Those of the Poeticus section require careful handling for success, but all the other kinds are of the easiest culture. Especially desirable for their beauty and delicious odor are the Jonquils, single and double, *Odorus rugulosus* and the Polyanthus or bunch-flowered Narcissus, the best known of of which are the Paper White and the so-called Chinese Sacred Lily.

The large-flowered sorts may be planted three in a 5-inch pot, and the smaller bulbs, as Jonquils and Bulbocodiums, five in a 5-inch pot. Set the bulbs with the neck at the surface. The soil and treatment given hyacinths will ensure success. If enough are planted to bring fresh pots forward every two weeks, a continuous succession of bloom can be maintained from December to May.

R. B. Whyte.

NARTHĒCIUM (an anagram of Anthericum, from the Greek Antherikos, supposed to have been the Asphodel). *Liliàceæ*. Bog-asphodel. About 4 species of perennial rhizomatous herbs, with linear, equitant basal lvs., wiry, erect, simple stem, and terminal racemes of yellow fls. Natives of Eu., E. Asia, Atlantic States and Calif. Stem 10 in.–2 ft. high: lvs. 3–8 in. long, 2 lines or less wide: fls. on bracted pedicels; bractlets linear; perianth of 6 narrowly lanceolate segments, reflexed or spreading in fl., soon erect, persistent; stamens 6; anthers 2-celled; stigmas small, terminal and slightly lobed: seeds numerous, ascending, with a long bristle-like tail at each end.

Californicum, Baker. Stem 1–2 ft. high: basal lvs. 1½–2 lines broad; cauline lvs. 2–3 in number, short; raceme 3–5 in. long, loose: fls. 30–40, yellowish green: capsules of paper-like texture, slender at top, 3-valved, when ripe a bright salmon color. Swamps, Calif. Introduced by dealers in native plants in 1888 or 1889.

M. B. Coulston.

NASEBERRY. See *Sapodilla*.

NASTŬRTIUM (classical Latin name of some cress, from *nasus*, nose, and *tortus*, distortion; referring to the effect of its pungency upon the nostrils). *Cruciferæ*. This genus includes the familiar Water Cress, *N. officinale*. It is too well known to need much description, and is of easy culture. (See *Cress*.) Water Cress is a hardy, aquatic, perennial plant, which grows in pure running water, and has a delightful peppery taste. It is much used for garnishing and for salads. The stems are spreading and take root at the lower joints. The lvs. are usually lyrately or pinnately parted and eared at the base: lfts. 3–11, more or less rounded and wavy: fls. small, white. An allied plant is the Common Winter Cress or Yellow Rocket (*Barbarea vulgaris*), but this is a dry land plant, with yellow fls. In the tropics *N. Indicum* is a desirable cress. This is an erect annual, with yellow fls. It is said to have been cult. in Europe, but Pailleux and Bois say it is useless outside the tropics. Nasturtium is a genus of 20 or more widely scattered species. They are herbs of various habit and duration, terrestrial or aquatic, glabrous or pubescent: lvs. entire or variously lobed or pinnatisect: fls. usually yellow; petals scarcely clawed, sometimes lacking; stamens 1–6: pods short or long; seeds usually in 1 series.

W. M.

NATIVE PLANTS. It has been said that Americans do not appreciate the indigenous plants of the country. This may have been true, but it is not true now. The desire for native and natural plants is one of the prominent movements of the present time. It is not strange that wild plants are not appreciated in a new country. The first necessity of our civilization was to fell the trees that ground might be tilled and habitations be built. The necessities of life were imported; the literature was exotic; the plants were transported from other lands. In Europe the conditions of living had become established. People had outgrown the desire to remove. They appreciated their own plants and also those from the New World. American plants attracted attention in Europe rather than in America.

Ten years ago, the writer made a census of indigenous American plants which were known to have been introduced to cultivation. The statistics were published in "Annals of Horticulture for 1891." It was found "that there are in North America, north of Mexico, about 10,150 known species of Native Plants, distributed in 1,555 genera and 168 families. Of these, 2,416 species are recorded in this census, representing 769 genera and 133 families. Of this number, 1,929 species are now offered for sale in America; 1,500 have been introduced into England, of which 487 are not in cultivation in this country." All these species are catalogued in the census. The only other account of the entire cultivated flora is that which is contained in this Cyclopedia, and for which the lists of ten years ago were a preparation. The final summing up of these volumes will show an increased number of Native Plants in cultivation in this country. A brief sketch of the history of recent efforts towards the introduction of Native Plants is given in the pretace to the census above mentioned.

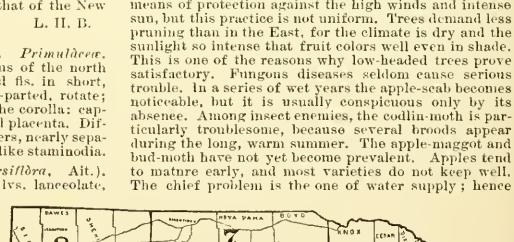
Formerly, the term "American Plants" had a technical meaning in England. William Paul in his book on "American Plants," published in London in 1858, writes as follows: "The history of American plants may be briefly told. The term is popularly applied to several genera, principally belonging to the natural order Ericaceæ. They are generally 'evergreen,' producing their flowers for the most part in the months of May and June." The book is devoted largely to rhododendrons, azaleas and kalmias, although European and other heaths are included.

There is a strong tendency towards the production of peculiarly American types and races even in Old World domesticated species, as of the carnation and sweet pea. As American plant-breeders come to give greater attention to native species, the divergencies between the horticulture of the Old World and that of the New World will be accentuated. L. H. B.

NAUMBÚRGIA (after Naumburg). *Primulàceæ.* SPIKED LOOSESTRIFE. A monotypic genus of the north temperate zone, with opposite lvs. and fls. in short, axillary, peduncled spikes; corolla 5–7-parted, rotate; stamens 5–7, opposite the divisions of the corolla; capsule 1-loculed; seeds several on a central placenta. Differs from Lysimachia in the spiked flowers, nearly separate stamens, and the presence of tooth-like staminodia.

guttàta, Mœnch (*Lysimàchia thyrsiflòra,* Ait.). Erect, perennial herb, 1–2½ ft. high: lvs. lanceolate, acute, narrowed at the base, lower cauline scale-like: fls. 2–3 lines broad, yellow, purple-dotted; lobes of the corolla linear-oblong. May–July. Swamps. B.M. 2012.—Grows best in shallow water. K. M. WIEGAND.

NEBRASKA, HORTICULTURE IN. Fig. 1463. The state of Nebraska presents somewhat peculiar horticultural conditions. It consists, for the most part, of gradually rolling prairies, slowly ascending toward the northwest The elevation of the southeastern part of the state is about 900 feet above sea-level, while that of the extreme northwestern part approaches 5,000 feet, the highest points somewhat exceeding that. The southeastern portion is rolling and broken, even rough in places, but affords the best general horticultural conditions. This is in part owing to soil and the possibility of more favorable sites, in part to the milder climate, and in part to the heavier rainfall of the region. The central part of the state is more even in surface, and subject to a high rate of evaporation from dry summer and winter winds, therefore less favorable. Beyond the prairies, to the westward, lie the sand-hills, which are in turn followed by the buttes and Bad Lands of the extreme western part. West of the 100th meridian fruit-growing of all kinds is difficult and uncertain, though, as the conditions come to be better understood and guarded, planting is being pushed farther and farther westward. As irrigation develops, fruit will be far more grown than now.



1463. The Nine Pomological Districts of Nebraska.

Commercial orcharding under irrigation is just beginning in the western and central portions of the state. According to E. F. Stephens, of Crete, Neb., who has closely followed its development, only about 300 acres have been planted, the largest number being in Lincoln county, which has about 180 acres. A beginning is also being made in small fruits under irrigation. Shipping facilities are excellent, since several fast freight lines already run through the state.

The State Horticultural Society has divided the state into nine fruit districts, which are very generally recognized in the discussions and recommendations of the society. These districts are indicated on the accompanying map. They are known, in the order numbered, as the (1) Southeastern, (2) Northeastern, (3) East-central, (4) West-central, (5) Lower Republican, (6) Southwestern, (7) Lower Niobrara, (8) Northwestern and (9) Western districts. In the revised fruit list published by the society, apples are recommended for general planting in Districts Nos. 1 and 2, and for trial in the balance of the state. Peaches are recommended for general planting in District No. 1 and for trial in Districts Nos. 5 and 6. Plums (native varieties) and cherries are recommended for Districts Nos. 1, 2, 5 and 6, and for trial in the balance of the state. Black raspberries are recommended in Districts Nos. 1 and 2, and for trial elsewhere. Grapes are recommended in Districts No. 1, 2, 5 and 6, and for trial in the other districts.

The fruits which thrive best in the state are apples, native plums, sour cherries and, in the southeastern part, peaches. Extensive apple orchards occur adjacent to the Missouri river, both north and south of the Platte. In some respects the methods in vogue differ from those in the eastern states. The trees are shorter-lived and are planted closer. Low heads are commonly employed as a means of protection against the high winds and intense sun, but this practice is not uniform. Trees demand less pruning than in the East, for the climate is dry and the sunlight so intense that fruit colors well even in shade. This is one of the reasons why low-headed trees prove satisfactory. Fungous diseases seldom cause serious trouble. In a series of wet years the apple-scab becomes noticeable, but it is usually conspicuous only by its absence. Among insect enemies, the codlin-moth is particularly troublesome, because several broods appear during the long, warm summer. The apple-maggot and bud-moth have not yet become prevalent. Apples tend to mature early, and most varieties do not keep well. The chief problem is the one of water supply; hence

thorough, continuous cultivation becomes imperative, though in the river counties some measure of success may be attained without it. In varieties the Ben Davis leads all others for market purposes. It is a large apple which yields well, colors well, keeps well and ships well. Thus far it has always sold well in market, notwithstanding its poor quality. It is, therefore, the Nebraska apple which far out-distances all competitors. Other varieties of prominence are Winesap, Janet, Wealthy, Grimes, and Jonathan. Duchess is the leading summer apple.

In the 100-acre orchard of E. T. Hartley, Lincoln, lath screens are used to protect the trunks from the fierce heat of the afternoon sun. The orchard is ten years old, and Mr. Hartley reports that the entire expense, including ground rental value, interest, replantings, and all the operations necessary to extensive culture has not exceeded $1 per tree. The cost of cultivation has been greatly reduced by the use of a broad, heavy cutting-blade devised by Mr. Hartley, which is attached behind the disk-harrow. This implement takes everything clean and leaves a fine, loose mulch on the surface. By its use 140 acres of orchard, containing nearly 12,000 trees, were kept in perfect condition from the latter part of April to the middle of August in 1898, an unusually wet and weedy season, at a cost of about $225, or less than two cents per tree.

The native plum thrives well over a wide range of the state. Some varieties suffer from the plum-pocket disease, and the plum-gouger is a troublesome insect, but the results are generally good. The leading varieties are Wild Goose, Miner, DeSoto, Wolf, Forest Garden and others. European varieties have been little planted as yet, though they succeed in the eastern portion of the state.

Cherries also thrive over a large part of the state. The fruit is sometimes deficient in size, but is remarkably free from insect attack, a wormy cherry being almost unknown. Early Richmond, Montmorency, and English Morello are the leading varieties. Sweet cherries do not thrive.

J. M. Russell & Son, of Wymore, on the southern boundary of the state, have made a decided success of peach-growing, and now have about 265 acres planted at Wymore and near Lincoln, 80 acres of which are in bearing. In 1896 they harvested 12,000 bushels. They head low, prune but little, and give thorough tillage during the early part of the season. Among the varieties which prove most satisfactory are Alexander, Hale Early, Early Rivers, Cooledge Favorite, Champion, Hill Chili and a variety locally known as Wright. The early varieties are particularly satisfactory, owing to comparative immunity from rot.

Among the smaller fruits, grapes thrive, but require more bearing wood than in the East and generally yield less. The leading eastern varieties are popular. Raspberries and blackberries suffer from drought. They may be grown for home use, but do not yield satisfactory commercial crops without water. The same is true of strawberries. Currants and gooseberries thrive, the latter yielding well, though the fruit is not large. Currants commonly yield but little, but under irrigation excellent results have been obtained.

The nursery interests of the state are important. The actual acreage of nursery crops is estimated at about 500 acres. Apple trees, and especially apple seedlings, are largely grown. Root-grafting is the method used in their propagation. This is partly because trees on their own roots are found best adapted to the conditions prevailing on the plains and partly because the weather is likely to be unfavorable at the time of budding.

Gradually, floriculture and ornamental gardening are increasing, particularly about the cities. Because of the clear climate, greenhouse work must become popular as soon as better markets develop. Seed-growing has already made the state considerable reputation.

FRED W. CARD.

In the eastern third of Nebraska, conditions are practically the same as those prevailing in Iowa and central Illinois. The most trying condition which has to be guarded against by the orchardists is the scant supply of water during the winter time which leaves the soil, which is naturally light and porous, so dry that the trees are frequently winter-killed or injured. The rainfall during the growing seasons averages about the same as that of Ohio, while the rain-fall during the entire year is very little over one-half that of the latter-named state.

The greatest need to insure better results for the fruit-grower is a better stock for plums and cherries. The Myrobalan and the Mahaleb are both widely used, but neither is adapted to the dry winters, and an earnest effort is being made to substitute in place of these something which shall be better fitted for the conditions. More or less has been done in the way of experimentation as to the use of the Sand Cherry, in the sandy parts of the state, as a stock, and with some degree of success. The effect of this stock is to dwarf the trees somewhat but not to a much greater extent than does the Mahaleb. The native plum is by far a better stock than the Myrobalan, but the period during which it may be budded is very short, and it is, consequently, very hard to use. On the other hand root-grafting of the plum is a process which has never come into very great use by reason of the small percentage which the average propagator is usually able to make unite and grow.

Root-grafting is practically the only method of propagating the apple, by reason of the fact that the work may be done at a time in winter when there is little else to do, and because the process can be carried on much more rapidly than budding. There is the further very important reason that trees grafted on piece-roots grow practically as cuttings, thus securing the tree on its own roots, lending on an average much additional hardiness.

Grapes thrive extremely well, especially in the eastern portion of the state. In the vicinity of Omaha, Plattsmouth and Nebraska City, many vineyards are established on a mercantile scale following the lead of the other very large growers located just across the Missouri river in Iowa.

Raspberries and blackberries produce profitable crops in the eastern and especially in the southeastern portion of the state.

Strawberries usually produce good crops of fruit of the highest quality. As a commercial venture very little has been done in growing the small fruits, by reason of the fact that in north Arkansas and southern Missouri, where the season is much earlier, immense quantities are produced with which all the state, practically, is supplied long before the home product is mature.

Currants and gooseberries are indigenous and thrive well in the eastern portion of the state, but bear less bountifully toward the west.

Wherever irrigation has been practiced, even on a small scale, anywhere in the state, the success in the growth of fruit has been very marked. In the parts of the state where there is insufficient rain-fall, the addition of water is all that is required to bring satisfactory results, the soil, except in the sand-hill portions of the state, being extremely rich.

In the early days of the territory and state the thickets and wooded strips along the streams were abundantly supplied with plums of delicious quality, two or three species of the grape, and the wild crab. There were also to be found, occasionally, gooseberries, currants and mulberries.

F. W. TAYLOR.

NECTARINE. A smooth-skinned peach (*Prunus Persica*, var. *lævis*, Gray). Fig. 1464. Formerly it was thought that the Nectarine was a distinct species of plant. By DeCandolle it was called *Persica lævis*. Roemer in 1847 made two species of it, *Persica violacea*, the freestone Nectarines, and *P. lævis*, the clingstone Nectarines. It is now known, however, that Nectarines often come from seeds of peaches, and peaches have come from seeds of Nectarines. Either may originate from the other by means of bud-variation. (See Darwin's "Animals and Plants under Domestication" for historical data.)

The cultivation of the Nectarine is in all ways like that of the peach. Because of the smooth skin of the fruit, it is perhaps more liable to the attacks of curculio. It is less popular in the market than the peach, and

therefore is less grown, although in California it is planted on a commercial scale. In that state it does well on almond stocks. Nectarines are usually inferior to peaches in quality, probably because less attention has been given to the breeding and selection of varieties, and from the fact that there is no conventional standard of excellence. Nectarines thrive wherever peaches do. Varieties are few, as compared with

1464. Nectarines.

peaches. The most prominent in this country are Boston, Downton, Hardwick, Early Newington, Pitmaston Orange, Stanwick, Humboldt, Lord Napier, Advance, Elruge. In color, size and season, Nectarines vary as peaches do. See also *Peach*, and *Forcing*.

L. H. B.

The Nectarine is grown in California almost exclusively for drying and canning, and even for these uses is but of minor importance. As compared with peaches for canning, the product of Nectarines is only about one-eighth of one per cent that of the peach, and for drying only about one per cent that of the peach. The varieties grown for both canning and drying are the white varieties, because they do not color the syrup in canning, and because when sulfured they make a beautiful, amber-colored, translucent product.

E. J. Wickson.

NEGRO'S HEAD. Unusual name for the ivory-nut palm, *Phytelephas macrocarpa*.

NEGUNDO. For *N. aceroides*, *Californicum* and *fraxinifolium*, see *Acer Negundo;* also Fig. 254.

NÈILLIA (named after Patrick Neill, at the beginning of the nineteenth century secretary of the Caledonian Horticultural Society at Edinburgh). *Rosàceæ*. Small, deciduous shrubs, with alternate, stipulate, usually 3-lobed lvs. and rather inconspicuous whitish fls. in simple or panicled racemes at the end of the branches. The one species in cultivation is not hardy North; it requires protection even in the Middle States, and is often killed to the ground in severe winters, but usually vigorous young shoots spring up and bloom and fruit in the same season. On account of its handsome bright green foliage it may be used as a border plant for shrubberies. It grows in almost any moderately moist soil. Prop. easily by greenwood cuttings under glass, and also by seeds. Seven species in the Himalayas and China. Fls. in racemes, with the pedicels shorter than the bracts; calyx-tube rather large, campanulate or almost tubular, with 5 erect sepals exceeding the 5 oval petals; stamens 10–30; carpels 1 or 2: pod dehiscent only at the inner suture, with several shining seeds. From Spiræa it differs, like the allied genera Physocarpus and Stephanandra, by its stipulate lvs. and shining crustaceous seeds.

thyrsiflòra, D. Don. Upright shrub, to 6 ft. high, but usually not exceeding 2 ft. if annually killed to the ground: branches angular, glabrous: stipules rather large, serrate: lvs. ovate, cordate at base, long-acuminate, usually 3-lobed, incised-serrate, glabrous above, pubescent only on the veins beneath, 2–4 in. long: fls. in panicled or sometimes solitary racemes; calyx-tube campanulate, pubescent, with the sepals about ⅛ in. long. Aug., Sept. Himalayas. R.H. 1888, p. 416.

N. Amurènsis, Nichols.=Physocarpus Amurensis.—*N. opulifòlius*, Brew. & Wats.=Physocarpus opulifolius.—*N. Tanàkæ*, Franch. & Sav.=Stephanandra Tanakæ.—*N. Torreyi*, Wats.=Physocarpus monogynus.

Alfred Rehder.

NELUMBIUM. The prior name is *Nelumbo*.

NELÚMBO (Ceylonese name). *Nymphæàceæ*. Usually written *Nelumbium*. Two species of strong-growing aquatics, one yellow-flowered and native to N. America, the other white or cyanic-flowered and native of the Orient. From Nymphæa, or the true water lilies, Nelumbo differs technically in having distinct carpels (which are imbedded in the receptacle), with a single ovule in each. Nelumbiums have strong and thick and usually tuber-bearing rhizomes, which creep in the earth in the bottoms of ponds and slow streams: lvs. peltate, orbicular or nearly so, entire, usually very large and long-petioled and mostly standing high above the water (sometimes floating): fls. large and showy, single, on peduncles which equal or exceed the lvs.; sepals 4 or 5; petals many, erect or erect-spreading; stamens many, on broad, short filaments: fr. a large, flat-topped perforated receptacle (Fig. 1465), in which are immersed the many carpels.

Nelumbiums are bold plants, suitable for large ponds and for masses. The oriental species, commonly but incorrectly known as Egyptian Lotus, is one of the best of large pond plants, being grown for its stately habit and showy flowers. Its roots should not freeze. Covering the pond with boards and litter, or filling it with water, may be made to afford ample protection to the roots.

A. *Fls. yellow.*

lùtea, Pers. American Lotus, or Nelumbo. Water Chinkapin. Lvs. usually raised 2–6 ft. out of shallow water, cupped or depressed in the center over the attachment of the petiole, 1–2 ft. across: fls. pale sulfur-yellow, 4–10 in. across, with obovate-obtuse concave petals and hook-appendaged anthers: root-tubers and seeds edible. In ponds and slow streams from S. Ontario and Mich. to Fla. and La.; usually local. Mn. 10:113.—A bold and useful plant for colonizing, deserving to be better known.

AA. *Fls. pink, red or white.*

nucifera, Gærtn. (*Nelùmbium speciòsum*, Willd. *Nelùmbo Indica*, Pers., and *N. Nelùmbo*, Karst.). Indian Lotus. Fig. 1465. Lvs. usually larger than those of *N. lutea*, glaucous: fls. fragrant, usually pink except in horticultural varieties, overtopping the lvs. Warmer parts of Asia and N. Australia. Gn. 28, pp. 426, 429; 43, p. 463; 44, pp. 229, 435; 50, pp. 267, 469. G.M. 38:809; 40:24; 41:833–5. I.H. 42:27. Gng. 5:114; 6:295; 15:334.—This plant is known to the trade as Egyptian Lotus, but the Lotus of the ancient Egyptians is a Nymphæa. This plant is not native to the Nile region. There are many named forms in cult. Var. **àlba** (*N. álbum*, Hort.), the "Magnolia Lotus," has white fls. Gn. 28, p. 427. G.C. III. 14:41. A.G. 20:369. Gng. 7:146. A.F. 14:726. Mn. 9:73. Var. **kermesìna**, Hort., has light pink fls. Var. **ròsea**, Hort., has rose-colored fls. There is a striped form known as var. **álba striàta**. A large double rose form is **rósea plèna**. A large double white form is known in the trade as *N. Shiroman* (F.E. 10, Suppl. Feb. 12). A free-flowering early sort with white fls. shaded pink is *N. Kinshiren* of the trade. There are other forms with Latin names.

L. H. B.

Whilst it may be historically true that the Egyptian Lotus is not a Nelumbium, the *Nelumbium speciosum* (or more properly *Nelumbo nucifera*) is everywhere known under that name, and it has been so distributed in good faith. In fact, it is doubtful if it is worth while to change the common name at this time.

America may be honestly proud of possessing such a fine aquatic plant as *Nelumbo lutea*, the well-known American Lotus. While China and Japan are the recognized homes of the splendid *Nelumbo nucifera*, they do not possess a yellow Lotus. In the Central states and near the Great Lakes, *N. lutea* is found in abundance, but it is scarce in the Middle Atlantic

and Eastern states. Where well established it is a magnificent plant, and when in blossom it is a sight worth traveling miles to see.

Nelumbiums, with Nymphæas and other aquatic plants, were among the few flowers known or cultivated by the ancients. No mention is made in history of a yellow Lotus prior to the discovery of America by white men, but over four centuries ago it was well known to and cultivated by the Indians in the waters of the Tennessee and Cumberland rivers, and was abundant on the tributaries of the Mississippi. It was carried northward and eastward by the Indians, and was established as far east as Connecticut. At the present time (1900) it is established and cultivated in most of the states of the Union.

The late Isaac Buchanan received tubers of *N. nucifera* from Japan, which were planted in a stream on Long Island, but there they perished. Later other efforts were made, and some tubers from the same source were received and planted by Samuel Henshaw in an artificial pond in the gardens of the late Mr. Green, at New Brighton, Staten Island, N. Y., where they grew most satisfactorily, some of the original stock being still in evidence on the estate.

About the same time E. D. Sturtevant, of Bordentown, N. J., who had introduced a number of tender

1465. The Indian Lotus, Nelumbium speciosum of the trade, but properly Nelumbo nucifera.

water lilies into commerce, and knowing of its being grown in the Jardin des Plantes, Paris, made an examination of the condition under which it existed there and determined to experiment in the culture at Bordentown, N. J. Roots were obtained from Kew Gardens and afterward planted in shallow water in a sheltered spot in a mill-pond near Bordentown. Here the plant grew amazingly, and its success and hardiness were fully established. From here was disseminated the now famous Egyptian Lotus, *Nelumbo nucifera*, to all parts of the United States. Several varieties have since then been introduced from Japan, including white and delicately tinted varieties, also deep rose, and double forms of both white and rose.

The cultivation of the Nelumbium is of the simplest. The roots or tubers should not be transplanted until there is evidence of growth, as the tubers, being usually buried deep in the soil below the water and out of the reach of frost, are not affected by the warm rays of sunshine as early as Nymphæas and other terrestrial plants. If Nelumbiums are dug before they start into growth, the tubers should be kept in a warm place or planted where the temperature is such that growth will begin at once. In the Middle Atlantic states and eastward and westward, May is the best time to transplant; southward earlier. Tubers may be planted in shallow water near the margin of the pond where it is intended they shall grow. The tuber should be placed horizontally in the soil, first making a little trench or opening to receive the same and covering with about three inches of soil. Means must be employed to keep the tuber securely in position and, if necessary, a stone or brick laid over the tuber. In artificial ponds a walled section should be built to hold the soil and keep the roots within bounds. The walls should have no corners at right angles; where there are such they should be rounded off, so that the runners are not intercepted and crowded in bunches at the corners. The natural soil and deposit in ponds are, in most cases, all that is required for these plants. They will flourish equally well in a stiff or tenacious soil, but when grown in artificial ponds it is best to use a mixture of two parts turfy loam and one part thoroughly rotted cow manure. Do not use fresh or green manure, and when possible have sods cut in the fall and stacked with the manure (in this case it may be fresh). In early spring have the same turned over two or three times before using. Resort may be had to cultivation in tubs, but the Lotus being such a gross feeder the result in most cases is that the plants are starved into rest at an early date. The leaves turn a sickly yellow and present a sorry appearance, and in many cases produce no flowers. If no other method can be adopted, then secure the largest tubs possible and during the growing season use liquid or artificial manure liberally.

It must be understood that while the Nelumbiums are hardy, they are only so as long as the tubers are out of the reach of frost. The depth to which frost penetrates the soil or water may be termed a dead line.

The tubers are farinaceous and edible, and are of considerable market value in Japan, but a taste must first be cultivated for them in the United States. The muskrat, however, has developed a highly cultivated taste for these sacred morsels, and it is necessary to watch these animals lest they take up their abode near ponds where the Nelumbiums grow. There are now in cultivation in the United States a dozen or more varieties, including single and double forms, pure white to deep rose, and yellow.

As to insect pests, black-fly or black aphis is sometimes troublesome. The best remedy is the lady-bird beetle and its larvæ. The leaf-cutter, or roller, is prevalent in some sections, and both young and old leaves are attacked, also the stems of the leaves and flowers. These have their natural enemies in the form of wasps and even sparrows, and as no liquid insecticide can be used, only such as are in the shape of a dry powder can be depended on. Paris green, mixed with land plaster or plaster and powdered slake lime, is excellent, but dry hellebore in powder-form, applied by a powder bellows is the best material to exterminate them.

WM. TRICKER.

NEMÁSTYLIS (Greek, *thread-like styles;* because the styles are not united). Syn., *Nemastylus*. *Iridàceæ*. A few species of tender American bulbs, with blue 6-lobed fls. about an inch across which last only a day. Strictly Nemastylis is a genus of 3 species, found only in the southern U. S. and characterized by having the filaments nearly free. Baker, however, in his Handbook of the Irideæ, includes Chlamydostylis as a subgenus of 14 spe-

cies found from Mex. to S. Amer. and characterized by having the filaments united in a column to the summit.

Generic characters are: root-lvs. linear: spathes 1 or more, peduncled: fls. more than 1 to a spathe; perianth without a tube; inner segments a little smaller than the outer: ovary 3-celled; ovules many, superposed; style branches alternate with the anthers; capsule loculicidally 3-valved. Some of the following species have been rarely advertised by dealers in native plants; the others by Dutch bulb-growers.

A. *Filaments nearly free. Subgenus Nemastylis proper.*

B. *Cluster of fls. single: spathes usually 1-fld.*

cœléstina, Nutt. Root-lvs. 1–2, 1 ft. or more long: stem 1½–2 ft. long, bearing 3–4 reduced lvs.: fls. sky-blue. Pine barrens, Fla. to S. C. and westward.

BB. *Clusters of fls. 2–3: spathes 2–3-fld.*

acùta, Herb. (*N. geminiflòra,* Nutt.). Root-lvs. 2–3, ½–1 ft. long: stem ½–1 ft. long, bearing 1 large linear leaf at the fork, and sometimes another below it: fls. "bright blue." Tex., Ark. B.M. 6666. F.S. 21:2171.

AA. *Filaments united in a column to the summit. Subgenus Chlamydostylis.*

B. *Fls. brownish purple, inner segments tipped yellow.*

brùnnea, Wats. Stem bearing a single leaf 6–8 in. long and a sheathing bract at the base of the peduncle: spathe 2½ in. long: outer segments obtuse, inner ones acuminate. Mex.

BB. *Fls. pale blue.*

Pringlei, Wats. Stem usually simple, with a single leaf at the middle: spathe 1½ in. long: fls. fragrant; outer segments obtuse, inner ones minutely apiculate. Mexico.

W. M.

NEMÈSIA (old name used by Dioscorides for some sort of snapdragon). *Scrophulariàceæ.* One of the horticultural novelties is *Nemesia strumosa.* It is one of the most interesting annual fls. introduced in the last decade of the nineteenth century. The flowers are very distinct in shape and have a wide range of color. The fls. are about an inch across and borne in great profusion. If started indoors in March and transferred to the open in May the plants will furnish a continuous sheet of bloom from June through September. The colors range from white, through pale yellow and rose, to orange and crimson, with numerous intermediate shades and a great variety of throat markings. This species has been known to botanists nearly a whole century; it grows only 50 miles from Cape Town, and it exhibits all these colors in the wild, yet it was never exploited until 1893, the first live plants seen in Europe being shown in 1892. Sixteen distinct color varieties were recognized in the first batch of cultivated plants, and the process of selecting strains has barely begun. The lower lip of the flower is about twice as broad as long, and notched at the point farthest from the center of the flower. The upper lip consists of 4 smaller, nearly equal lobes, the side lobes being usually more nearly separate than the middle ones.

Nemesias are slender annual or perennial herbs, sometimes woody at the base: lvs. opposite: fls. in racemes at the tips of branches or rarely solitary in the axils; calyx 5-parted; corolla-tube short, with an anterior spur or sac: capsule compressed, septicidal, with navicular valves. About 30 species, all S. African. The following belong to the group with fls. in racemes. They are glabrous or nearly so, 1–2 ft. high, and branched from the base. J. N. Gerard thinks that Nemesias are not destined to become popular. He finds that the seed is likely to germinate poorly and that the young seedlings are quick to damp off.

A. *Fls. with a sac at the base.*

strumòsa, Benth. Root-lvs. oblong-spatulate, entire; stem-lvs. lanceolate or linear, entire; lobes of the upper lip relatively shorter and broader than in the next two species; throat with a long beard inside; lvs. few, the floral ones bract-like; capsules 4–6 lines long, 3–4 lines wide. B.M. 7272. G.C. III. 12:277. R.H. 1898, p. 87 (var. *grandiflora*). V. 16:7.—Var. **Sùttoni** is the strain commonly offered. G.M. 35:459.

AA. *Fls. with a spur at the base.*

versicolor, E. Mey. Lowest lvs. stalked and ovate; upper lvs. few, sessile, oblong, lanceolate or linear, entire or toothed: lobes of the upper lip equal among themselves and as long as the lower lip; throat with 2 callosities, pubescent: spur incurved, about as long as the lower lip, 4 lines. Not advertised by name, but *N. compácta,* vars. *álba* and *cærùlea,* Hort., belong here. R.H. 1898, p. 87.

floribúnda, Lehm. Lower lvs. stalked, ovate, dentate; upper ones few, small, ovate or lanceolate, subsessile: lobes of the upper lip not quite as long as the lower lip: fls. white; throat lined with blue, the callosities of the palate yellow. According to De Candolle, the lobes of the upper lip are about equal among one another, but in B.R. 24:39 the middle lobes are narrower and longer than the side lobes. Advertised abroad. Fls. smaller and with a narrower range of colors than *N. strumosa.*

W. M.

NEMOPÁNTHUS (Greek words, referring to the thread-like flower-stalks). *Aquifoliàceæ.* Mountain Holly. A genus of one species, confined to eastern N. America. It is a medium-sized, hardy shrub, rarely cult. for its showy pendulous red berries, which are borne in autumn. The genus is distinguished from the common holly (Ilex) as follows: calyx often obsolete, especially in the fertile fls.: petals distinct, linear, acute: stamens free. (In Ilex the calyx is present and persistent in both fertile and sterile fls.: petals slightly grown together at the base, oblong, obtuse: stamens grown to the base of the corolla.) Nemopanthus is now largely used, and the plants attain 10 ft. in cultivation.

fasciculàris, Raf. (*N. Canadénsis,* DC.). Dense-growing, purplish barked shrub, attaining 6 ft.: lvs. often clustered on spurs, 1–1½ in. long, elliptical, mucronate, entire or minutely serrate, thin but firm: fls. about 2 lines wide: drupes dull red, about 3 lines thick. B.B. 2:393.

NEMÓPHILA (Greek, *nemos,* a grove, and *phileo,* to love; referring to the habitat of some species). *Hydrophyllàceæ.* Nine species of hardy annual herbs, all from N. Amer., are now referred to this genus. They are of dwarf, compact habit, and produce an abundance of showy bell-shaped fls. from early spring to late summer; hence they are valued for bedding and for the border. Whole plant more or less hairy: stem diffuse, becoming prostrate: lvs. alternate or opposite, pinnately lobed or divided, petiolate: flower-stalks usually longer than the lvs., terminal or lateral, slender, 1-fld.: fls. blue, white, purple, or variously spotted; calyx 5-parted; lobes erect or spreading, with 5 supplementary reflexed lobes alternating with them; corolla broadly bell-shaped or wheel-shaped, deeply 5-lobed, with 10 scaly appendages on the inside of the throat.

S. W. Fletcher.

All the species are propagated by seeds sown in the fall or early spring. If plants are desired for very early flowering, seeds should be sown in Aug. out-of-doors and the plants transplanted in late fall; or they may be started under glass in March. Seeds sown in April in the open will give plants for summer and fall flowering. These are preferably transplanted. If a later sowing is made it should be where the plants are to flower. Most species seed freely, but they cannot be trusted to re-seed themselves satisfactorily. Nemophilas love a moist loam with partial shade, but accommodate themselves to any good garden soil and a sunny site. *N. Menziesii,* however, should be planted in a moist place if possible, and *N. aurita* is impatient of intense sun. Few hardy annuals are more valuable for bedding than Nemophilas because of their compact habit and free-blooming qualities. They are also fine for cut-flowers, window boxes and pot-plants. *N. insignis* and *N. Menziesii,* with their many garden varieties, are most popular.

F. W. Barclay.

The above method of culture is not adapted to all parts of the country. It is very doubtful whether Nemophilas have ever been successfully grown outdoors during summer in the vicinity of Boston. The writer has tried them over and over again without success. His

best results have been attained by growing them in pots in a cool greenhouse. Nemophilas are said to do beautifully outdoors in Maine, where the summer is cooler and moister. In Scotland, Nemophilas are esteemed most delightful garden plants. An odd thing about Nemophilas is that cats are extremely fond of rolling in them as they do in catnip.

ROBERT CAMERON.

A. *Lvs. mostly alternate, all with an ear-shaped and clasping base or winged petiole.*

aurita, Lindl. Stem 1–3 ft. long, weak, with stiff, recurved bristles by which the plant tends to climb; lvs. deeply cut above into 5–9 oblong or lanceolate segments, which are usually turned back: later fls. not accompanied by lvs., and hence appearing to be in loose racemes; corolla about 1 in. broad, violet. Low, shady grounds. Calif. B.R. 19:1601.

1466.
Nemophila insignis.
(× ½).

AA. *Lvs. all opposite, base not ear-shaped.*

B. *Scaly appendages on throat of corolla narrow.*

Ménziesii, Hook. & Arn. (*N. atomària,* Fisch. & Mey. *N. discòidalis,* Lem.). Stem straggling, succulent: lvs. pinnatifid, the lobes ovate, nearly entire, slightly hairy: fls. light blue to nearly white, marked with dark brown spots towards the center. Low grounds, western Amer. B.R. 23:1940. B.M. 3774. P.M. 5:99. V. 2:267.—Under cult. the species has given rise to var. **discoidàlis** (*N. discòidalis,* Lem.), in which the spots on the corolla are confluent into a large, brownish purple eye. Garden forms of this are: var. **vittàta,** velvety black margined with white (Gn. 9:232); var. **élegans** (*N. atomària,* var. *élegans,* Hort.), fls. pure white, with chocolate center (V. 2:268), and var. **oculàta,** white, with purple center.

BB. *Scaly appendages very broad or roundish.*

C. *Fls. blue, with white center.*

phacelioides, Barton. Leaf segments obtuse, margin slightly ciliate: lower lvs. narrowed into a short petiole; lobes notched at end: corolla bell-shaped. Western N. Amer. B.R. 9:740. B.M. 2373.

CC. *Fls. white, with a purple blotch at the tip of each lobe.*

maculàta, Benth. Lvs. lyre-shaped, the 5–9 short lobes obtuse, entire; upper lvs. wedge-shaped, sometimes only 3-lobed: fls. 1–2 in. wide, showy; sometimes the purple blotch is poorly defined. Common in western and central Calif. P.M. 16:6. F.S. 5:431. R.H. 1849:201. V. 2:267.—Good garden forms of this are var. **álbida** and var. **grandiflòra.** Var. **variegàta** has variegated leaves.

CCC. *Fls. vivid blue (pure white or lilac in vars.).*

insignis, Benth. Fig. 1466. Lvs. pinnately parted into 7–9 oblong segments, which are sometimes 2–3-lobed or toothed: fls. ½–1 in. wide. Low ground, Calif. B.R. 20:1713. B.M. 3485. P.M. 3:151. V. 2:268; 5:168; 8:215. —There are many garden varieties of this desirable species. Among these are var. **grandiflora,** with large, clear blue fls. (Gt. 34:370); var. **álba,** fls. pure white; var. **marginata,** fls. blue, edged with white.

S. W. FLETCHER.

NÉNGA (Malayan name). *Palmàceæ.* Two or three species of Malayan palms, one of which is cult. as *Areca pumila.* In Areca, however, the ovule is erect and fastened at the base, while Nenga belongs to a large group in which the ovule is fastened on the side and more or less pendulous. Nenga is distinguished from the 5 cultivated genera of this group (which are listed under Hedyscepe) by the following characteristics: staminate fls. with narrow sepals much surpassing the petals; stamens 6; anthers erect. Nengas are graceful spineless palms with erect, slender, ringed trunks: lvs. terminal, equally pinnatiseet; segments linear, acuminate or obliquely 2-fid or 3-fid; margins folded back at the base; primary nerves sparsely scaly below; rachis 3-sided; petiole short; sheath cylindrical, strongly oblique at the throat: spadix with a short peduncle and slender pendent branches: spathes 2, the lower symmetrical, lanceolate, folded, 2-crested, the upper unsymmetrical, persistent, or lacking: bracts 3-fid.; bractlets scaly: fls. white: fr. ellipsoidal, smooth, reddish orange.

Wendlandiàna, Scheff (*Arèca pùmila,* Blume). Stem 10–20 ft. high, 2–3 in. in diam.: lvs. 8–9 ft., pinnate nearly to the base; pinnæ alternate, ensiform, acuminate, 2½ ft. long, ⅓–1⅓ in. wide, bright green, coriaceous, 2-ribbed; petiole slender; sheath sub-ventricose, 2 ft. long. Java.

JARED G. SMITH.

NEOTTÓPTERIS. Consult *Thamnopteris.*

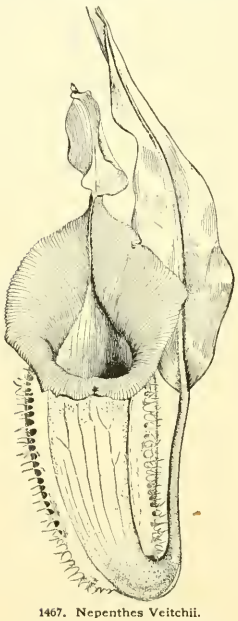
NEPÉNTHES (name explained below). *Nepenthàceæ.* About 35 species of insectivorous pitcher plants which rank among the wonders of the vegetable kingdom. The word Nepenthes occurs in the Odyssey, where Helen threw a drug into the wine which was supposed to free men from grief, anger and all ills. In describing one of these pitcher plants, Linnæus said: "If this is not Helen's Nepenthes, it certainly will be for all botanists. What botanist would not be filled with admiration if, after a long journey, he should find this wonderful plant! In his astonishment past ills would be forgotten when beholding this admirable work of the Creator."

There are about 35 species of Nepenthes, all tropical and mostly Malayan. They are all remarkably alike, and different from anything else in the world. They are probably supported in part by animal matter which is caught in their pitchers. The fluid in the bottom of the pitchers is largely secreted by the plants and is comparable to the gastric juice. It helps to decompose and digest the food. The glands which secrete this digestive fluid may be seen with the aid of a hand-lens. This fluid is used by the natives of Borneo as a remedy for indigestion, as fresh ripe figs are often used. It has been analyzed and found to contain pepsin. It is secreted before the lids open, even in the baby pitchers, and the lid is believed to keep the rain from diluting the viscid fluid.

It is supposed that insects are attracted by nectar glands situated near the mouth of the pitchers, and perhaps also by the odor of the fluid. Later, the odor of decomposing flies is thought to attract flesh-eating insects, and thus a second harvest is secured. One species is said to be still further specialized in its tastes. Burbidge relates that *N. Veitchii,* from its peculiar habit of growing on dead trees, catches mainly such beetles and boring insects as exist in decayed timber, and ants innumerable. There is, however, a species of ant which outwits one of the pitcher plants; viz., *N. bicalcarata.* "This ant's object is water, and to obtain this it bores a hole through one of the large sugar-secreting glands of the stalk behind the pitcher, just

below the water-line, seeming to know by instinct—or is it experience?—that the water of the pitchers so operated upon will well up the hole as it does in a syphon pipe." The two species of pitcher plants just mentioned are constantly robbed by insect-eating birds. The Borneans call the pitcher plants "monkeys' cooking pots." Burbidge was presented by the natives with delicious rice daintily cooked in clean pitchers of *N. Hookeriana*.

The pitchers of Nepenthes are borne at the ends of the leaves. They are usually flask-shaped, sometimes mug-shaped, rarely cylindrical. (For examples of these 3 shapes, see Figs. 1470–72.) A pitcher always has a lid,



1467. Nepenthes Veitchii.
Celebrated for its wide rim.

a mouth surrounded by a rim, a little spur at the back (which is usually just where the midrib of the back of the pitcher joins the lid) and two wings running up and down the front of the pitcher. The broader these wings and the longer their fringes the handsomer the pitcher, as a rule. The rim around the mouth sometimes bears numerous downward-pointing teeth, which have been supposed to turn back insect refugees.

With the exception of about half a dozen very distinct types which will be mentioned later, Nepenthes species are too much alike. So far as records and pictures go, practically all the hybrids are as much alike as so many peas, at least so far as pitchers are concerned. A few exceptional kinds can be told by the hairiness or broad bases of their leaves, or by venation. Even the flowers furnish little help in distinguishing species and, as a rule, the cultivator wants pitchers, not flowers. The pitchers will "hold water," but it is doubtful if the present classification of them will. The difficulties of the case will be apparent from the following account of how the pitchers change in form and color as a plant develops.

How the Pitchers Change.—When a Nepenthes is grown from seed, the very first thing that develops after the cotyledons is a little pitcher. "These young pitchers," according to Harry James Veitch, "are at first continuous with the blade and form part of it; then sessile, and later separated from it by a prolongation of the midrib; they are produced simultaneously with the blade, not after it, as in the adult plant. * * * As leaves continue to be produced, so a gradual change in the size and shape of the pitchers becomes apparent. Instead of the pitcher being produced simultaneously with the blade, it lags behind, as it were; the midrib is perceptibly prolonged beyond the apex of the blade while the pitcher is still rudimentary, and this continues till leaves are produced with full-sized pitchers. If the stem is allowed to grow without check, the pitchers appended to the leaves successively produced undergo a change in shape and dimensions still more remarkable than what takes place during the progress of development from the infantine to what is regarded as the perfect form of the pitcher. * * * [See Fig. 1470.] As leaf after leaf is produced from the ascending stem, the pitchers first become longer and narrower; then follows a gradual diminution of the parts while the pitchers are being modified from the flask shape to the cylindric shape; the ventral wings constantly diminish in breadth and the ciliate fringe disappears until the place of the wings is denoted only by two narrow keels, and instances have been observed in which even these are obliterated. The pitchers not only undergo change in size, form and color, but they also change their position in respect to the prolonged midrib. By the time the seventh or eighth pitcher has been produced above that which we have already referred to as the perfect pitcher, the prolonged midrib has made half a revolution on its own axis, so that the pitcher has now its dorsal side toward it. As the pitchers diminish in size with the ascent of the stem, so when a certain stage of growth is reached, and as the plants arrive at the time of flowering, they cease to be produced altogether, but the stem continues to grow and produces leaves with prolonged midribs, affording a support to the plant and its inflorescence while maturing its seed. Sir Hugh Low observed of *N. ampullaria*, which he saw in Sarawak, that the first formed leaves have no blades but only pitchers, with which the ground is frequently covered as with a carpet."

Other habits of growth are no less interesting. Some of the Nepenthes keep to the ground, but most of them climb tall trees. The species are, with very few exceptions, all more or less epiphytal, and *N. Veitchii* is said to be wholly so. As they climb, the tips of the leaves take a turn or two around a nearby twig. Like all pitcher plants, Nepenthes are poorly supplied with roots, and as the plants grow above they are said to die away below. Thus their lowest point may be 20 feet above ground. However, they can send out new roots all along the stem and penetrate the thick covering of moss and lichen often found on the trunks of trees growing in hot, moist regions. As to size of pitchers the species vary greatly. The kinds first known to cultivation, as *N. gracilis*, *ampullaria* and *Phyllamphora*, have pitchers about as large as a man's thumb. Others, as *N. Northiana*, *Veitchii*, *Rafflesiana*, *bicalcarata* and *sanguinea*, may be 6–12 in. long or more. The great Rajah, which is a dwarf plant about 4 ft. high, with its pitchers resting on the ground in a circle, has been known to have pitchers holding 2 quarts, while in another was found a drowned rat. The fls. of a Nepenthes are produced in a pseudo-terminal fashion on old plants. The male and female fls. are borne on separate plants. They are green or purple, small, a hundred or so in a raceme or panicle, with 4 perianth segments. Ordinarily Nepenthes are not permitted to flower, the stems being stopped, partly for the sake of taking cuttings, but chiefly because the most and best pitchers are produced from the new growth of compact plants rather than from tall and straggling specimens.

"Of the 36 species, or thereabouts, known to science,' says Veitch, "14 are confined to Borneo, 3 more are common to that and adjacent islands, 13 more are extra-Bornean but strictly Malaysian, the remaining 6 are much scattered—there is one in North Australia, one in New Caledonia, one in Ceylon, one in the Seychelles, one in Madagascar and one in northeast India." The

great majority of the species are found on equatorial islands at low elevations near the seacoast, in a climate of wonderfully uniform temperatures and a yearly rainfall of 70–80 in. As a general rule the greatest heat of the day does not exceed 90–92° F., while it seldom falls during the night below 74° F. The usual daily range is only 10° and the extreme 15°. During a large part of the year the air of the Nepenthes region is nearly saturated with moisture, so that a very slight fall of temperature produces copious dews and showers even at high temperatures and low altitudes.

The species which grow at high altitudes form a most remarkable and exceptional group. There are four of them, which grow only on Kina Balou, a mountain in Borneo, which is 13,700 feet high. These species are found at altitudes ranging from 5,000 to 10,000 feet, in the following order: *N. Lowii, Edwardsiana, Rajah* and *villosa*. These four are amongst the largest and most distinct of all Nepenthes. *N. Lowii* gapes at one like a sardonic pelican (see Fig. 1472). *N. Rajah* has pitchers of immense size and unique shape (Fig. 1472). *N. villosa* and *Edwardsiana* differ from all other species in their rim, which is cut up, as shown in Fig. 1472, into rather few large coarse disks instead of numerous fine, crowded rings. Some of the best collectors in the world have been sent after these treasures, and the history of the chase for them rivals the most romantic and exciting orchid hunts. Up to Sept., 1897, only the Rajah had been successfully brought to our northern hothouses, where it remains an unwilling prisoner. The capture of the others should be one of the horticultural triumphs of the twentieth century. In the particular zone in which these four species grow there is a peculiar combination of cold and wetness in the air rising from the sea which meets the cold air decending from the peak. There is a constant state of "Scotch mist" associated with a temp. of 40–45° F. "When plants of these noble species are brought down to the hot plains they soon die off, and even if shipped safely in Wardian cases, they cannot withstand the heat of the sea voyage." The Rajah was introduced in the form of seeds.

To grow the Rajah may well be regarded as the summit of the gardener's skill. "It is terrestrial in yellow loam and decomposed granite, with its great basal pitchers resting and often buried in dead leaves, moss and other detritus or debris." *N. villosa* is also terrestrial; *N. Lowii* and *N. Edwardsiana* epiphytal. For the Rajah and its three companions Burbidge proposes a cold greenhouse surrounded by hot ones, so arranged that the warm moisture-laden air of the latter could be admitted to the former, thus imitating the cold moisture-saturated atmosphere of their native habitat. In such a house the Odontoglossums of the higher slopes of the Andes and many other difficult things should be able to thrive.

As a whole, Nepenthes is a difficult group to grow. Pitcher plants deserve a house of their own, and they often get it. Within the group, however, there are certain kinds which are relatively easy to cultivate. The hybrids, as a rule, are easier to grow than the species. Anyone who wishes to begin in a small way should start with *N. Mastersiana*, which is often said by connoisseurs to be the largest, best colored and most desirable of all Nepenthes. This fine hybrid is named after Dr. Maxwell T. Masters, editor of the Gardeners' Chronicle, who has done more to preserve careful records of Nepenthes hybrids than anyone else. Some of the points of a good hybrid are: It should be easy to propagate and easy to grow; every leaf should bear a pitcher; the pitcher should be large and highly colored, the reddest ones being the most attractive; the wings should be broad and copiously fringed; the plants should never be without some pitchers, and the perfect pitchers should last all summer at least, without browning at the top. All or nearly all these points are met in *N. Mastersiana*, pitchers of which have been known to last two years.

Among the species one of the most distinct types is *N. Rafflesiana*, which is remarkable for its high neck supporting the lid. A form of it, known as *N. Hookeriana*, is thought to be a parent of more hybrids than any other Nepenthes. The wide rim of *N. Veitchii* gives its pitchers a strong individuality and makes it a favorite for hybridizing. The four Kina Balou species are very distinct, but for most people impossible. *N. albo-marginata* and a supposed hybrid of it named *cincta* are remarkable for a white ring just below the rim. The rest are for the hobbyist.

The literature of Nepenthes is very extensive. The only botanical monograph is that by J. D. Hooker in DeCandolle's Prodromus 17:91–105 (1873). This is an account in Latin of 34 species, of which a dozen or so are cultivated. For the origin and development of the pitchers, see J. D. Hooker in Trans. Linn. Soc. 22:415–424 (1859). For the horticultural side, see Veitch and Burbidge in Jour. Roy. Hort. Soc. of London 21:226–262 (1897).

Nepenthes are fanciers' plants *par excellence*. The problems connected with their insectivorous habits are of perennial interest to scientists, students and the general public, but to the gardener the fascination of Nepenthes lies chiefly in their oddity and the difficulty of their culture. The feeling of curiosity soon yields to a sense of their beauty. America is too young to have made many contributions to fanciers' groups in general, but the hybrid Nepenthes raised in America by the late Mr. Taplin are so remarkable for their continued success on both sides of the water that they deserve separate notice. W. M.

The Taplin Hybrids.— It is certainly true that my father's hybrids were superior to many of the European hybrids. He worked on them for many years, but left nothing whatever in the form of manuscript concerning them. He never wrote for publication, and the notes he made from time to time were distinctly hieroglyphic, and merely concerned the period of blooming of different kinds. He began his work in this line while at Chatsworth, but many varieties did not flower satisfactorily in England, or did not ripen viable seed. Consequently, he succeeded much beyond his expectations in this warmer climate. Most of his hybrids resulted from two varieties blooming at different times, and the undersigned has vivid recollections of an array of little thumb-pots, carefully lined and sealed with tinfoil, and kept in a dry place, which contained pollen saved from one period of blooming to another. He used *N. Phyllamphora, Hookeriana, distillatoria* and *Sedenii* quite largely. The majority of his hybrids were sold to B. S. Williams, of London, when the George Such collection at South Amboy was dispersed. *N. Taplini* is a very richly colored one. *N. Morganiæ, Outramiana, Williamsii* and *Lawrenceana* are his varieties, and the writer is fairly certain that *Courtii* is also, Court and Outram both being warm personal friends. Most of the plants were renamed when sent out in England.

Emily Taplin Royle.

Nepenthes Culture at Washington, D. C.—Nepenthes are increased by cuttings and by seeds. The ripened shoots, with 4 or 5 leaves attached, make the best cuttings. They may be put in to root from December till the end of January, but under proper conditions the operation may be performed at any time during the year. Some of the free-rooting kinds, such as *N. Dominiana, N. lævis, N. gracilis, N. Phyllamphora* and *N. Mastersiana*, may be rooted in sand under a glass with a little moss tied around the base of each cutting. Under this treatment the temperature of the sand should be about 80° F. When the roots show through the moss they should be put in small pots and kept close for a couple of weeks. The most satisfactory method of propagation is to put the base of each cutting through the hole of an inverted 2-inch rose pot, plunging the pot in sphagnum moss in a temperature of from 80–90° F. See Fig. 1468. During the operation of rooting they must be kept in a close propagating frame and frequently syringed. See Fig. 1469. When the roots are about three-quarters of an inch long the cuttings should be potted, using a mixture of finely chopped fibrous peat, moss and sand, with a little finely broken charcoal added. They should be replaced in the moss and kept close until the pots are fairly well filled with roots and then gradually hardened off. All of the kinds do best suspended from the roof of a hothouse, the temperature of which should not fall below 65° F. in winter. The plants may be grown either in orchid pots or baskets.

In potting or basketing plants from 4-in pots, large pieces of potsherd and charcoal should be firmly placed here and there among the potting material, which should consist of rough fibrous peat, moss and sand. The plants should not be allowed to grow as vines unless they are intended to produce seed. When large-sized pitchers are wanted the ends of the shoots should be nipped out after several leaves have been made and the pitchers are in the process of development; this throws strength into the last-formed leaves and produces very large pitchers. When the plants are in active growth they should be well drenched with water at least once each day and syringed frequently, but care should be taken not to overwater newly potted specimens. They should at all times be shaded from bright sunshine, and when a house is devoted to them, or partly occupied with plants requiring similar treatment, it should be shaded with cloth fixed to rollers. Well pitchered plants may be taken from the growing house and exhibited in good condition for a long time in a house under conditions which would be unfavorable for their growth. All of the hybrid forms are of easy culture. *N. Mastersiana*, *N. Dominiana*, *N. Siebrechtii*, *N. Outramiana* and *N. Henryana* produce pitchers very freely. The species, as a rule, are not quite so free, but some of them thrive equally as well as the garden forms. *N. Rajah*, *N. Northiana*, *N. sanguinea*, *N. albo-marginata* and *N. bicalcarata* are all more or less difficult to manage, as the conditions under which they grow in their native haunts are sometimes not easily imitated. *N. ampullaria*, *N. Rafflesiana*, *N. Phyllamphora*, *N. distillatoria*, *N. lævis* and *N. Kennedyana* are usually seen well furnished with pitchers. G. W. Oliver.

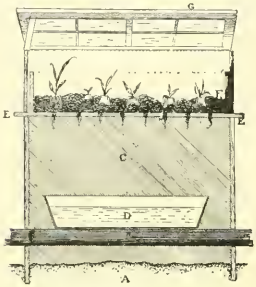
Nepenthes Culture at New Rochelle, N. Y.—In propagating these charming plants the writer prefers cuttings of well-ripened wood, not too hard, and of 2 or 3 eyes in length. The lvs. are trimmed in one-half or more. The cuttings are placed in a close glass case, with a steady bottom heat of at least 80° or 85° in a bed of cocoa fiber or of sphagnum moss and sand mixed. The cuttings are always kept moist, and only enough air is allowed to reduce condensation.

After they are rooted, which takes from two to three months, they are planted into shallow pans or orchid

1468. Good method of propagating Nepenthes.

The cutting is placed in an inverted pot. The stick at the right wedges the cutting and keeps it tight; it may also carry the label. The pot is set in two vertically to show how the roots form in the air, without the aid of sand, water or even moss.

cribs in a mixture of fibrous peat and sphagnum moss, with perhaps some pieces of charcoal and crocks at the bottom. This material should be packed in firmly and tied down. Then set the plants again into bottom heat, in order to have them firmly established. Increase the air gradually until the plants are sturdy enough to be placed in the greenhouse, either upon a rack or suspended from the roof. The temperature where Nepenthes are grown should never be less than 60°, and it might be as high as 80° or 90°, providing plenty of moisture is given. Copious syringing, and during the



1469. A simple propagating frame.

Used by Robert Shore for propagating Nepenthes, Dracænas and other tropical subjects.

summer months, dipping of the plants in water, is very beneficial. When the plants get too high, say above 18 in. or 2 ft., and their pitchers become smaller and smaller, as they grow taller, the best plan is to cut them back to within 4 or 5 eyes of the crown. Then the next growth of new leaves will give the very finest and best pitchers. When well established in their pans or cribs, and while in good growing condition, a light concoction of liquid manure is very beneficial. When the potting material is exhausted, it is essential that it be renewed at least once a year. Very fine plants can also be raised from seeds. When the plants are in bloom the miniature flowers should be carefully examined, to see that both sexes are represented, for if either sex be absent there can be no fertilization. The seed, when ripe, should be sown in pans in much the same material as was prescribed for cuttings, the pans placed in about the same sort of a place, and the material always kept moist. It takes from six weeks to two months to germinate the seed. After that, care must be taken that the young seedlings do not damp off. Once they are strong enough, with 2 or 3 leaflets, they can be pricked off and planted into other pans and fresh material, at the same time gradually accustomed to the air, and thus in from eighteen months to two years' time nice little plants may be had. In the experience of the writer the following kinds are more easily cult. than the others: *N. Alleniana*, *ampullaria* and vars., *bicalcarata*, *Chelsoni*, *Curtisii*, *cylindrica*, *distillatoria*, *Dominiana*, *Eyermanni*, *hybrida*, var. *maculata*, *Hookeriana*, *Hookeriana* var. *elongata*, *lanata*, *Lawrenciana*, *Mastersiana* (2 vars.), *Morganiana*, *Outramiana*, *Patersonii*, *picturata*, *Rafflesiana*, var. *insignis*, *Savageana*, *Sedeni*, *Siebrechtii*, *Stewartii*, *Taplini*, *Tildeniana*, *Veitchii*, *Zeylanica* var. *rubra*. H. A. Siebrecht.

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CC. *Shape of pitcher quite cylindrical* ..... 3. **sanguinea**
CCC. *Shape of pitcher cylindrical, but narrower above.*
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CC. *Base of lid not notched.*
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EE. *Shape of pitcher like a mug.*
F. *Mouth of pitcher bigger than the bottom* ..... 24. **Rajah**
FF. *Mouth of pitcher smaller than the bottom.*
G. *Wing fringes spurse* ..... 25. **Chelsoni**
26. **Edinensis**
GG. *Wing fringes copious* ..... 27. **Rafflesiana**
EEE. *Shape of pitcher like a flask, i.e., inflated below, more or less cylindrical above.*

Nos. 28 to 45. Flask-shaped and Spotted Pitcher Plants, a key to which will be found on page 1073.

1. **bicalcarata,** Hook. Young pitchers bowl-shaped, 3½ x 3 in.: old pitchers 8 x 6 in., including a neck 2 in. long: color of pitchers less vivid than in *N. sanguinea*. Borneo. I.H. 28:408. G.C. II. 13:201. Gn. 17:237; 33, p. 29.—The spurs resemble the fangs of a snake. Apparently no other species has such spurs. G. W. Oliver writes that all the specimens he has seen have been yellowish green, covered with rust-colored, downy material.

1470. How the pitchers change their shape.

The earliest and best are mug-shaped ones; the topmost pitchers of old and tall plants are cylindrical. *N. Rafflesiana*, both from same plant. Adapted from B. M. 4285.

1471. Three old-time Nepenthes.

Much confused in collections and difficult to distinguish: *N. Phyllamphora* above, *N. Khasiana* in the middle, *N. distillatoria* below.

2. **Madagascariénsis,** Poir. Lvs. leathery, reddish beneath, 5 x 1¼ in.: pitcher 4–6 in. long, crimson, flask-shaped; mouth nearly circular, with scarcely any neck. G.C. II. 16:685.

3. **sanguinea,** Lindl. Pitcher 12 x 2 in., quite cylindrical; no neck. Malaya. F.S. 22:2343. G.C. 1872:541; II. 11:13. F.M. 1874:128.—This is one of the very few species that has a sessile leaf.

4. **Mastersiàna,** Veitch (*N. sanguínea* × *N. Khasiàna*). Pitcher 7 x 2 in., cylindrical, but the upper third narrower, deep claret red, sometimes with spots of darker red. G.C. II. 16:749; 21:249. I.H. 33:618. Gn. 23:390. Gng. 4:183.—This superb hybrid has the sessile leaf and red pitcher of *N. sanguinea*, with a form of pitcher intermediate between its two parents. There is a dark colored variety and a lighter colored one.

5. **Kennedyàna,** F. Muell. Pitcher 5 x 1½ in., reddish, cylindrical, but narrower above; lid as large as the month and nearly horizontal. Australia. G.C. II. 17:257.

6. **lanàta**, Masters. Here used for the plant with the green pitcher and yellow rim which is one of two things passing in the trade as *N. Veitchii*. The name *N. lanata* was first used at the bottom of plate 261, vol. 23 of I.H., but the accompanying text is headed *N. Veitchii*, and Masters declares that the text refers to *N. Veitchii* and not to the plant there figured. Masters gave, therefore, the first description of *N. lanata* in G. C. II. 17:178, but he fails to clearly distinguish the two plants. He says that *N. lanata* has blackish hairs on the under side of the lvs. and that the rim is "ultimately reddish brown." The typical *N. Veitchii* (B. M. 5080) is said to have "rufous" hairs on the under side of the lvs. Borneo. I.H. 23: 261 (probably a poor picture). Gn. 17: 237 (as *N. Veitchii*). *N. lanata* should perhaps rank merely as a variety of *N. Veitchii*.

7. **ampullària**, Jack. This and Nos. 2 and 12 Hooker distinguishes from all other species by their inflorescence, which is more or less panicled, instead of racemose. Pitcher oblong, 3 in. long; lid smaller than the mouth, erect or bent back. Malaya. F.S. 22:2325 (copied from B. M. 5109 and reversed.—Var. **vittàta** is a spotted var. I.H. 24:272. Var. **màjor** also has been offered. Burbidge says this is the only kind that has no honey glands, but J. M. Macfarlane declares that all species have honey glands on the rim, though this species has none on the rudimentary lid.

8. **ruféscens**, Veitch (*N. Zeylanica*, var. *rubra* × *N. Courtii*). Stem reddish, closely covered by broad decurrent leaf-stalks, which are about 1 in. long; lvs. 12 x 2½ in.: pitcher narrowly flask-shaped, 7½ x 2 in. — Fresh pitcher sent by Siebrecht differs from G.C. III. 4: 669 in having a very narrow green rim, higher neck and lid faintly flushed red above but freely spotted below.

9. **hýbrida**, Veitch. Lvs. 8–9 x 2: pitcher 5 in. long; mouth ovate; lid spotted; neck rather high. *N. Khasiana* was the male parent. Judging from the structure, J. M. Macfarlane thinks that *N. gracilis* was the female parent. Fully described in G. C. 1872:541.

10. **cylindrica**, Veitch. Hybrid of *N. Zeylanica*, var. *rubra* × *N. Veitchii*. Pitcher 6–8 in. long, 1–1½ in. wide, pale green, with a very few crimson spots, inflated below, but perhaps not quite flask-shaped; lid oblong, much spotted at least beneath; rim is shown as narrow and regularly rolled back in G.C. III. 2:521, but said to be frilled and somewhat dilated toward the neck.

11. **lævis**, Lindl. Lvs. narrow, leathery, without pubescence, fringes or teeth: pitcher 2–4 in. long, cylindrical but narrower above; wings narrow-fringed or not; rim entirely without ribs (a unique character, if constant). Java, Singapore. G.C. 1848:655.

12. **distillatòria**, Linn. Fig. 1471. This is one of the oldest names among lovers of the pitcher plants, but Masters says the plants cultivated under this name are really *N. Khasiana*. *N. distillatoria* is one of very few species that has panicled fls. Lvs. narrowed into a broadly winged, half-clasping stalk, which is scarcely or not at all decurrent; texture leathery: pitcher 4–6 x 1–1½ in., cylindrical, obscurely dilated at the base, more or less flushed red upwards; lid about as large as the mouth and horizontal. Ceylon. P.M. 4:1. L.B.C. 11: 1017. Not B.M. 2798, which is *N. Khasiana*.

1472. Five distinct types of Nepenthes.

Beginning from the top they are: *N. villosa*, *Lowii*, *Rajah*, *Rafflesiana*, var. *Hookeriana* and *Rafflesiana*. The first three belong to the famous Kina Balou group. The fourth is the parent of more hybrids than any other kind.

N. Zeylanica, Rafin., is referred by Index Kewensis to *N. distillatoria*. *N. Zeylanica*, var. *rubra*, Hort., is an old garden name which Veitch in G.C. III. 2:521 refers to *N. hirsuta*, var. *glabrescens*. An abnormal form of *N. Zeylanica*, with 2 midribs and 2 pitchers from the same leaf, is shown in G. C. II, 13:309.

13. **Phyllámphora**, Willd. Fig. 1471. Lvs. with a long winged petiole, half-clasping or less; nerves numerous longitudinal; texture of young lvs. membranous: pitcher 4–6 in. long, subcylindrical; lid about as large as the mouth and horizontal. Cochin China, Moluccas.—The above description is from Hooker, not from B.M. 2629, which, according to H. J. Veitch (J. H. S. 21:232), is really *N. gracilis*. In R. H. 1887, p. 511, is a picture labelled *N. Phyllamphora*, which is the same thing as the one in R. H. 1861. p. 173, labelled *N. distillatoria*.

14. **Khasiàna**, Hook. Fig. 1471. Not advertised, but probably common in cult. under the name of *N. distillatoria*. Lvs. sessile, clasping, shortly decurrent; nerves pinnate; texture firm, but hardly leathery: pitcher 4–7 x 1½–3 in., spotted above, larger than those of *N. distillatoria*. Himalayas. B. M. 2798 (erroneously as *N. distillatoria*). In B.M. 2798 the pitcher is cylindrical but narrow at the bottom. J. M. Macfarlane verifies this description, and adds that the true *N. Khasiana* has a long, narrow pitcher which is green or tinged with brick red.

15. **Búrkei**, Mast. This is distinguished from apparently all other species by the absence of wings. It has the wide rim, with irregular fluted projections of *N. Veitchii*. Pitcher 8 x 2½ in., oblong, but swelled in the lower third. Borneo. G. C. III, 6:493. Var. **prolífica**, Mast., has a more slender habit, narrower lvs., smaller and less highly colored pitchers, produced in greater profusion.

16. **Véitchii**, Hook. Fig. 1467. A splendid plant, remarkable for its extremely wide rim, which sometimes attains 2 in., and is often boldly scalloped at the margin instead of being rolled neatly back. Being one of the most distinct in general appearance, it has been much used in hybridizing. The name has been endlessly confused. It is commonly said that there are two forms of *N. Veitchii* passing in the trade—one with a spotted pitcher and red rim, and the other with a green pitcher and yellow rim. The latter is here called *N. lanata*. The former is indisputably the true *N. Veitchii*, since the original description of *N. Veitchii* consists in a mere citation of B. M. 5080, which, by the way, bears the erroneous legend of *N. villosa*. B.M. 5080, therefore, is the type of *N. Veitchii*, and that is a spotted pitcher with a red rim. *N. Veitchii* has a large hairy pitcher, attaining 10 x 3½ in., which tapers toward the base, is nowhere bulged, and has an ovate mouth, surrounded by a wide, high-necked rim; the lid seems small in comparison. Borneo. F. M. 1877: 265. G.C. II, 16:781. Perhaps, also, G.C. II, 18:809 (as *N. sanguinea*). Burbidge says that *N. Veitchii* is a true epiphyte, growing 20–100 ft. above ground and differing from most, if not all, other species in actually clasping the trunks and bearing its lvs. in a 2-ranked fashion.

17. **villòsa**, Hook. Fig. 1472. This is distinct from all other species here described by its rim, which is com-

posed of distant disks which are circular except for teeth which project down into the pitcher. *N. Edwardsiana* is probably the only other kind with such a rim. Borneo. Trans. Linn. Soc., plate 69, not B.M. 5080, which is *N. Veitchii*.—Not in cultivation anywhere as yet.

18. **cincta**, Mast. The leaf tapers to a broad dilated base, which is "intermediate between the sessile leaf of *N. Northiana* and the long tapering stalk of *N. albomarginata*:" pitcher cylindrical, rounded at the base, 7–8 x 2¼ in.; rim lobed, not entire as in *N. albo-marginata*; back of pitcher 2-spnrred. Borneo. G. C. II. 21: 576.—The white band is narrower than in *N. albomarginata*.

19. **grácilis**, Korth. Lvs. sessile, long decurrent: pitcher cylindrical but inflated at the base and constricted at the middle, 2½–4 in. long. Borneo. B.M. 2629 (erroneously as *N. Phyllamphora*). V. 3: 221 (poor as to shape of pitcher). Var. **májor** is the only form offered.

20. **Northiàna**, Hook. Remarkable for its wide rim, which is said to attain 2 in. and is perhaps nearly as wide as in *N. Veitchii*. Pitcher flask-shaped, 12–16 x 3½–5 in. Borneo. Gn. 23, p. 496. R.B. 21, p. 271. S.H. 1, p. 107 (all the same cut). G.C. II. 16: 717 is misleading as to width of rim, and was perhaps done from a very young pitcher.

21. **Curtisii**, Hook. This species is very distinct by reason of the shape of the pitcher. Pitcher 7 x 1½ in., as nearly cylindrical as in any species of the genus. The mouth and neck are like *N. Rafflesiana*, but the pitcher is not bulged below and the fls. are green instead of dark red. This species is unique by reason of its spurs. The back spur is borne not at the junction of back and lid as usual, but on the back of the pitcher. Moreover, the midrib of the lower surface of the lid is produced into 2 spurs—one near the base and a longer one near the apex. Borneo. B.M. 7138. G.C. III. 2: 689. I.H. 35, p. 59 (same cut). G.C. III. 6: 661.—A fresh pitcher sent by Siebrecht shows that this is even more distinct and splendid than the pictures show.

22. **mixta**, Mast. (*N. Northisii*, Veitch). Hybrid of *N. Northiana* and *N. Curtisii*, having the cylindrical pitcher of the latter but not the 2 spurs on the lower side of the lid. The lvs. are remarkable in being somewhat notched at the apex of the blade. Pitcher 8 in. long; rim deep crimson. G.C. III. 13: 47. G.M. 36: 754. R.B. 21, p. 268. —According to Veitch, the fls. are panicled.

23. **ampullària**, var. **vittàta**. Here may be sought the spotted var. of *N. ampullaria* described at No. 7. In I.H. 24: 272 this spotted var. is represented with a small, broadly oblong, unconstricted pitcher and a lid bent back to a wholly exceptional degree.

24. **Rájah**, Hook. Fig. 1472. Distinguished by the immense size of the pitchers, their odd shape, the great mouth, the disproportionately large lid, and also by the tendril which is given off, not from the apex of the leaf, as usual, but from the under surface a short distance below the apex. Pitchers a foot or more long and three-fonrths as wide. Borneo. G.C. II. 16: 493. Gn. 22, p. 122. F. 1883, p. 157.

25. **Chélsoni**, Veitch (*N. Dominii* × *N. Rafflesiana*). Pitcher 3–4 x 2½ in. More fully described in G.C. 1872: 542.

26. **Edinénsis** (*N. Rafflesiana* × *Chelsoni*). Raised at the Botanic Gardens of Edinburgh, but not described so far as known. A.F. 7: 381.—Cult. at U. S. Botanical Gardens, Washington, D. C.

27. **Rafflesiàna**, Jack. Fig. 1470. This is one of the most distinct species by reason of its high-necked pitchers and purple fls. The young pitchers are mug-shaped (excluding the neck), while the mature ones (rarely seen in cult.) are actually wider at top than at bottom and taper gradually to the base without any sudden constriction. Stem green and glabrous: young pitchers often 5½ x 3 in.; old ones sometimes 7 x 2 in. India. B.M. 4285 (copied and reversed in F.S. 3: 213). F.S. 16: 1698; 22: 2343. F. 1850: 77; 1872, p. 221. G.C. III. 12: 553; 1872: 541. R.H. 1869, p. 130 (as *N. Rafflesea*). Var. **insignis**, Mast., is a more robust plant: stems covered when young with white chaffy scales: pitchers mug-shaped. 9 x 4 in., thickly beset with small, brownish, stelliform hairs. G.C. II. 8: 425. Var. **nivea** is densely covered with white down. Var. **pállida** is cult. at Washington, D. C. Var. **Hookeriàna** (*N. Hookeriàna*, Low. *N. Hoòkeri*, Alphand). Fig. 1472. Said to be the parent of more hybrids than any other kind. It seems to be a distinct botanical variety from Borneo, differing essentially in having a low neck. According to Masters (G.C. II. 16: 812), it also differs in having a short petiole which is very broad at the base, and a flatter, not hood-like lid. Also the lvs. are thicker, with 3–5 secondary nerves on each side of the midrib and parallel to it, the tertiary transverse nerves much more closely arranged than in *N. Rafflesiana*. The figure in G.C. II. 16: 813 (repeated in G.C. III. 12: 557, I.H. 41, p. 145, and S.H. 1: 57) is inaccurate as to the spur, which is distinctly shown as a prolongation of the rim, rather than of the lid or the midrib of the back. See A.G. 18: 877. Also Alphand's Promenades de Paris, last colored plate of the volume of plates.

FLASK-SHAPED AND SPOTTED PITCHER PLANTS.

(The key continued from page 1071.)

This group (Nos. 28 to 45) is composed wholly of hybrids, and the blood of *N. Rafflesiana* enters largely into them. The high-necked kinds are more like typical *N. Rafflesiana*, while the low-necked kinds resemble *N. Rafflesiana*, var. *Hookeriana*. All of these hybrids seem to be more flask-shaped than *N. Rafflesiana*, i. e., they are proportionately longer, and more constricted above.

F. *Neck extremely high, associated with a very oblique mouth, as in Fig. 1472 (bottom).*
G. *Spots red and yellow: pitchers chiefly red* ..... 28. **atrosanguinea**
GG. *Spots red and green.*
H. *Rim wide, 1 in. or so* ..... 29. **Dicksoniana**
HH. *Rim narrow.*
I. *Wings wavy and fluted (as well as fringed)* ..... 30. **intermedia**
II. *Wings not wavy* ..... 31. **Courtii**
FF. *Neck shorter: mouth less oblique. See Fig. 1472 (next above bottom).*
G. *Spots red and yellow, hardly green.*
H. *Rim parti-colored* ..... 32. **coccinea**
33. **Williamsii**
HH. *Rim self-colored, dark* ..... 34. **Morganiana**
GG. *Spots red and green.*
H. *Wings wavy (as well as fringed)* 35. **Dormanniana**
HH. *Wings not wavy.*
I. *Shape of lid roundish rather than oblong.*
J. *Base of lid heart-shaped, i. e., notched* ..... 36. **Sedeni**
JJ. *Base of lid not notched.*
K. *Rim green* ..... 37. **Lawrenciana**
38. **Wrigleyana**
KK. *Rim dark red or parti-colored.* 39. **Stewartii**
40. **Henryana**
41. **Eyermanni**
42. **Ratcliffiana**
II. *Shape of lid oblong* ..... 43. **Outramiana**
44. **Dominii**
45. **hybrida**, var. **maculata**

28. **atrosanguínea**, Hort. American hybrid, said to resemble *N. Sedeni* and *N. rubra*. Said to be much richer in color than *N. sanguinea*. Pitcher 6 x 2½ in.; rim red and blackish. G.C. II. 17: 827.

29. **Dicksoniàna**, Masters (*N. Rafflesiana* × *Veitchii*). This has a rim almost as big as that of *N. Veitchii*, but not so flat. Pitcher 10 x 3½ in.: lvs. with 3 parallel nerves between midrib and margin. G.C. III. 4: 541.

30. **intermèdia**, Veitch (*N. Rafflesiana* × ?). Stem covered with pale rnst-colored down: lvs. taper to both ends: pitcher 6 x 2½ in.; rim flattish, parti-colored; lid less hooded than in *N. Rafflesiana*. G.C. II. 17: 179; III. 12: 125. F. 1875, p. 257 (neck too low).

31. **Cóurtii**, Veitch (*N. ? × Dominii*). Stem purplish and hairy: pitcher 5 x 2¼ in., of very firm textnre. G.C. III. 6: 845.

32. **coccinea,** Mast. American hybrid of unknown parentage. Pitcher 6 x 3 in., crimson, slightly speckled with yellow; rim red and black; lid spotted. G.C. II. 18:169. I. H. 41, p. 143.—Cannot be distinguished by original descriptions and pictures from the next. The leaf-margins of both have numerous, regularly disposed, minute teeth.

33. **Williamsii,** B. S. Williams (*N. Sedeni* × *N. Hookeri*). Pitcher 4–5 in. long, intermediate in shape between its parents; interior spotted red; lid reddish brown beneath. G.C. II. 14:40.—In Gn. 27:494 the rim is erroneously shown as dark and self-colored, but a fresh pitcher sent by Siebrecht has a beautiful, shiny, richly parti-colored rim.

34. **Morganiàna,** Hort. (*N. Mórganiæ*, Hort.). One of Taplin's American hybrids, supposedly between *N. Hookeri* and *N. Phyllamphora*. Lvs. reddish, margins entire; pitcher medium-sized. Originally said to have a green lid, but in Gn. 23:390 the lid is light yellow, spotted red, at least below.

35. **Dormanniàna,** Masters. Possibly an American hybrid; parentage unknown. Lvs. finely ciliate at the edges; pitcher 6 x 3; lid spotted. G. C. II. 17:525.—Fresh pitcher sent by Siebrecht has a parti-colored rim.

36. **Sèdeni,** Veitch. Masters, in his careful description in G.C. 1872:542, says that the lid is cordate, but this feature is not shown in the Veitchian trade cut used in F. 1872, p. 54 and S. H. 1:104. Stem terete, glabrous: lvs. 7 x 1¾ in.: pitcher (probably not mature) 3 x 1 in

37. **Lawrenciàna,** B. S. Williams (*N. Sedeni* × *Hookeri*). Pitcher 4–5 in. long, intermediate in shape between its parents, and in 1880 said to be a brighter red than any kind except *N. sanguínea*. Lvs. slightly serrate; lid reddish beneath. G. C. II. 14:40. I. H. 29:460 (lid spotted above).

38. **Wrigleyàna,** Hort. Said to be another hybrid of *N. Phyllamphora* and *N. Hookeri*. Lvs. light green, like those of *N. Phyllamphora*, 10–12 x 1¾–2 in., acute at both ends, glandular beneath, and with 2 or more parallel nerves on each side of the midrib. G. C. II. 17:143.

39. **Stèwartii,** Veitch (*N. Stùartii*, Hort.?). Same parentage as *N. Morganiana*. Lvs. said to have the light green color of *N. Phyllamphora*, with the leathery texture of *N. Hookeri*. Pitcher intermediate in size. F. 1879, p. 157, where the pitcher is said to have a "prominent rib" on the back. Specimens cult. at Cornell Univ. have parti-colored rims.

40. **Henryàna,** B. S. Williams (*N. Hookeri* × *N. Sedeni*). Pitcher 5 x 2. I.H. 29:460. Gn. 27:494. Here may belong I.H. 34:15, but the pitchers are larger and redder except on the lid, which is nearly green and unspotted, the rim decidedly parti-colored and the wings entirely unfringed, the last point being the most suspicious.

41. **Éyermanni,** Hort. Lvs. 10 x 2 in., dark green, leathery, with a few minute teeth on the margin: pitcher 4 x 1½ in., handsome dark red, with relatively few green spots; mouth ovate, rather short-necked; lid roundish, as large as the mouth, freely spotted above, scarcely beneath; rim narrow, slightly parti-colored; wings in the specimen sent with a short fringe above and none below. Described from fresh pitcher furnished by Siebrecht.

42. **Ratcliffiàna,** Veitch (*N. Phyllamphora* × *N. Hookeri*). Lvs. light green, leathery, 12–15 x 1½ in.: pitcher 5–6 x 2 in.; rim parti-colored; lid about as large as the mouth, ovate, glandular and spotted below. G.C. II. 17:178.

43. **Outramiàna,** B. S. Williams (*N. Sedenix N. Hookeri*). Pitcher 5 in. long; interior well spotted; rim parti-colored; lid spotted, at least below. G.C. II. 14:41. F. 1880, p. 156 (same cut). F.M. 1879:384.

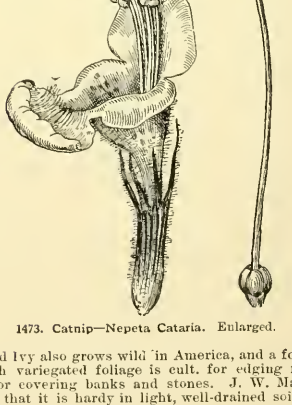
44. **Dominii,** Veitch (*N. Dominiana*, Hort.? *N. Raffflesiàna* ×?). Stem purplish, slightly downy: lvs. 16–18 x 3 in., 1-nerved: pitcher 6 x 2 in., lid spotted.—Siebrecht sends a small pitcher with a high neck, narrow, parti-colored rim, lid faintly flushed above, freely spotted below. There is more green than red in the pitcher.

45. **hybrida,** var. **maculàta,** Hort. (*N. Khasiana* ×?). Stem glabrous: lvs. 13 x 2¼ in., 1-nerved: pitcher 5 x 1½ in., cylindric, but slightly contracted above the middle. The color of the lid is not recorded. J. M. Macfarlane thinks that *N. gracilis* was the other parent.

The following kinds have been offered in America but cannot at present be distinguished from those given above: *N. Alleniàna*, Hort. Siebrecht.—*N. amabilis*, Hort. Said to be a hybrid between N. Hookeri and N. Rafflesiana; int. 1886.—*N. Amesiàna*, Hort. Said to be a hybrid between N. Rafflesiana and N. Hookeriana; int. 1893.—*N. Clàytonii*, offered 1895 by Pitcher and Manda.—*N. compàcta*, Hort., is figured in Gn. 27, p. 497, but can hardly be distinguished by the figure from any other spotted, flask-shaped, low-necked kind.—*N. Craigiàna*, Hort. Siebrecht.—*N. Edwardsii*, Hort. Pitcher and Manda.—*N. Elmenhorstiàna*, Hort. Siebrecht.—*N. excèlsior*, Hort. Hybrid of Rafflesiana and N. Hookeriana. Pitcher 9 in. long, spotted, oblong, rounded at base.—*N. Findlyàna*, Hort. A hybrid with medium-sized spotted pitchers; int. 1886.—*N. Hamiltoniàna* is said to be the same as *N. coccinea*.—*N. Hibberdii* is probably the correct name of the hybrid advertised by Pitcher & Manda as N. Hilberdii. Pitcher spotted; lid green above, indistinctly marked with red below; 1883.—*N. Johnsonii*, Hort. Siebrecht.—*N. Lànewoodii* or *N. Lònewoodii*, Hort. Siebrecht.—*N. Màyi*, Hort. Siebrecht.—*N. Osborneana*, Hort. Pitcher & Manda.—*N. Paradisæ*. Hybrid, 1883. Pitcher spotted, much narrowed near center, 4–5 x 2–2½; rim green; lid green above, reddish beneath.—*N. Patersonii*, Hort. Saul. Spotted. Pitcher cylindrical but narrower above.—*N. picturàta*, Hort., is figured in Siebrecht's catalogue with an oblong pitcher, which is slightly wider below but not flask-shaped.—*N. Pitcherii*, Pitcher & Manda. Hybrid between N. Paradisæ and N. Henryana. Pitcher deep pink; 1895.—*N. Rœblingii*, Pitcher & Manda, 1895. Pitcher almost globular, medium-sized, spotted.—*N. Savageàna*, Siebrecht, has mug-shaped, spotted pitchers.—*N. Sedmannii*. Hort. Pitcher & Manda.—*N. Siebrechtiàna* is said to have immense pitchers, resembling N. Amesiana but lighter colored and dented on one side.—*N. Sèabrightii* of Saul's catalogue is probably the same thing as the preceding, though Saul says it is in the style of N. Rafflesiana.—*N. splèndida*, Hort. Pitcher & Manda.—*N. superba*, Hort. Hybrid having the habit of N. Hookeriana and pitcher intermediate between N. Hookeriana and N. Sedeni. F.M. 1881:434.—*N. Tàplini*, Hort. Siebrecht.—*N. Thorpèiana*, Hort. Siebrecht.—*N. Tildenii*, or *Tildendiàna*, Hort. Pitcher & Manda.—*N. Wàdleyana*, Hort. Siebrecht, a flask-shaped pitcher which is much redder above.

W. M.

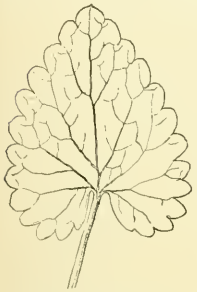
NÉPETA (Latin, perhaps from Nepete, an Etrurian city). *Labiàtæ*. This genus includes Catnip, Ground Ivy and some other hardy perennial herbs of the easiest culture. Catnip is a familiar weed near dwellings and barns. Cats are fond of it, and Catnip tea is a pungent memory with those who have survived the era of homely simples. The seeds of Catnip are still offered.



1473. Catnip—Nepeta Cataria. Enlarged.

Ground Ivy also grows wild in America, and a form of it with variegated foliage is cult. for edging flower-beds or covering banks and stones. J. W. Manning writes that it is hardy in light, well-drained soils, but sometimes winter-kills in moist soils. It is also used in

vases and baskets. Nepeta is a genus of about 120 species, mostly in the northern hemisphere outside the tropics. Perennial or annual herbs, tall and erect, or dwarf and more or less trailing: lvs. dentate or incised, the floral ones like the rest or reduced to bracts; whorls of fls. crowded in a dense spike, or in a loose cyme, rarely few-fld. and axillary: fls. blue or white; calyx 15-nerved; corolla 2-lipped; perfect stamens 4: ovary 4-parted. The genus is placed between Lopanthus and Dracocephalum, and is characterized as follows: calyx tubular, the mouth straight or oblique, 5-toothed; stamens usually parallel, ascending; anther cells divergent or divaricate. See Fig. 1473.



1474. Leaf of Catnip.

Nepeta Glechoma is a perennial creeping plant of easy culture in any loose, rich, fairly moist soil, in either shade or full sunlight, but to be luxuriant in the open it should have a moist soil. It is a very rapid grower, and is therefore often troublesome when planted with other low-growing plants. It is useful as a ground covering in shrubbery borders and shady places generally.

A. *Blooms small, inconspicuous.*

B. *Color of fls. white or nearly so.*

Catària, Linn. Catnip or Catnep. Catmint. Figs. 1473, 1474. Tall and erect: lvs. heart-shaped, green above, whitish below, crenate, stalked. Eu., Orient.

BB. *Color of fls. blue.*

Glechòma, Benth. Ground Ivy. Gill-over-the-Ground. Makes a dense mat: lvs. roundish, more deeply notched at the base than Catnip, and green on both sides, the floral ones like the others, not reduced to bracts as in the other kinds here described: whorls axillary, few-fld. Nat. from Eu., Asia. B.B. 3:87.—The green-lvd. form is less cult. than var. **variegata** (*N. hederàcea*, Trev., var. *variegàta*, Hort.).

AA. *Blossoms larger, showy, blue.*

B. *Lvs. not notched at the base.*

macrántha, Fisch. Erect, branching, nearly glabrous: lvs. short-stalked, ovate-lanceolate, green on both sides: cymes peduncled, few-fld.: fls. 1 inch long; bracts minute. Altai. B.M. 2185 (*Dracocephalum Sibiricum*).

BB. *Lvs. notched at base.*

C. *Fls. pedicelled.*

betonicæfòlia, C. A. Mey. Upper lvs. green on both sides: bracts a half shorter than the calyx. Caucasus.

CC. *Fls. sessile.*

Mussini, Spreng. Diffuse; branches ascending: lvs. green above, whitish below: racemes unbranched; bracts much shorter than the calyx. Caucasus, Persia. R.H. 1891:300. B.M. 923 (*N. longifolia*).—Not adv.

F. W. Barclay and W. M.

NEPHÈLIUM (old name of the burdock applied to this genus because the rough fruits were supposed to resemble those of burdock). *Sapindàceæ*. The Litchi nut can be obtained in the dried state in the larger markets of the eastern states and is often seen on the tables of trans-Pacific steamers. The tree is cult. in the West Indies but not in the U. S., unless in Porto Rico. The whole fruit is about as large as a small walnut. The outer covering consists of a thin, brittle shell, under which is a layer of soft, aromatic and delicious pulp; finally in the center is a rather large, smooth, hard-shelled seed, from which the pulp readily separates. It is one of the most delicately flavored fruits that the tropics produce. In dried state it will keep a long time, and can be transported to distant parts. Thus dried, the pulp shrinks from the shell and becomes tough and less aromatic and delicate.

The tree is a native of southern China and the Malay archipelago, where it has been cult. for at least 1,500 years. It has been brought to the extreme south of Japan and to various tropical countries. It was introduced to southern Fla. in 1886. Only a limited area is suited to its growth, as it does not readily adapt itself to climates which differ much from that peculiar to its original habitat. It is a good-sized tree, said to attain a diameter of 2–3 ft. It is probably cult. under glass in a few European botanic gardens for its economic interest.

The preceding account is abstracted chiefly from G. C. Georgeson's article in A.G. 12:269. W. A. Taylor writes: "The Litchi nut is also sold in Chinese stores in the larger cities in the form of preserves packed in syrup in glass jars. In this form the peculiar fragrance and flavor of the fresh fruit are well preserved."

Nephelium is a genus of about 20 species of oriental trees: lvs. alternate, abruptly pinnate; lfts. not quite opposite, oblong, entire, rarely serrate: panicles axillary and terminal, many-fld.: fls. small, regular, polygamo-dicœcious; calyx small, cup-shaped, 4–6-cut; petals none or 4–6, villous or with 2 scales; stamens 6–10: ovary 2–3-lobed. Botanically the genus is allied to the soap-berry.

1475. Litchi Nut—Nephelium (×½).

Litchi, Cambes. Litchi or Leechee. Fig. 1475. Lfts. about 3 pairs, lanceolate, 1-nerved beneath. China. A. G. 12:269.

NEPHRÒDIUM. A name used at Kew for species of Dryopteris, which see. *N. emersum*, var. *cristatum* is advertised, but unknown to botanists.

L. M. Underwood.

NEPHRÓLEPIS (Greek, *kidney scale;* alluding to the indusia). *Polypodiàceæ*. A genus of subtropical ferns with pinnate lvs., the pinnæ articulated to the rachis, free veins and a reniform or roundish indusium rising from the apex of the upper branch of a vein. See *Fern*.

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A. *Rootstocks bearing tubers.*

1. **cordifòlia,** Presl. (*N. tuberòsa*, Hook.). Stalks 1–4 in. long: lvs. 1–2 ft. long, 1½–2 in. wide, with close, often imbricated pinnæ, usually blunt at the apex. Mexico to Japan and New Zealand. *N. pectinata*, Schott, is a form with auricled lvs. and no tubers. *N. Duffii*, Moore, is apparently a monstrous form from New Zealand, with tufted habit and branching fronds. *N. cordata compacta*, Hort., is said to be a var. of *N. cordifolia*.

AA. *Rootstocks without tubers.*

B. *Margins entire or crenulate.*

2. **exaltàta,** Schott. Sword Fern. Stalks 4–6 in. long: lvs. 1–2 ft. or more long, 3–6 in. broad; pinnæ close, usually acute, the edge entire or slightly crenate, the upper side auricled. Fla. to Brazil, Hong Kong and East Africa. The "Boston Fern," or var. *Bostoniensis* (see Plate XI) of the horticulturists, is highly valued but has no standing as a botanical variety. It is sometimes in the trade under the horticultural name *N Paradisæ*. *N. exaltata*, var. *plumosa*, Hort., has double, overlapping crests. *N. Philippensis*, Hort., with dark-lvd., dark green foliage, probably belongs here. *N. Washingtoniensis* and *N. Washingtoniensis*, var. *pendula*, Hort., are said to be forms of this species. G. W. Oliver says that their fronds last well after being cut.

3. **acùta,** Presl. (*N. Baùsei,* Hort.). Lvs. 2–4 ft. long, 8–12 in. wide, on short slightly scaly stalks; pinnæ ½–1 in. wide, acute, with entire or slightly crenate margins, the lower basal angle rounded, the upper auricled: indusia suborbicular. Fla. to Brazil and in the tropics of the Old World. — *N. rufèscens,* Presl., is a woolly variety. *N. tripinnatifida* is said to be a variety of this species.

BB. *Margins pinnatifid.*

4. **davallioìdes.** Kunze. Lvs. drooping, 2–3 ft. long, 1 ft. or more wide; lower pinnæ inciso-crenate, the upper narrower, with deeper lobes. In cultivation the pinnæ are forked often several times and are sometimes irregularly crested; their form resembles the horticultural variety **fùrcans.** Java. — Var. **fùrcans mùlticeps** is also advertised.

N. serrulàta cristata, once advertised by John Saul, seems unknown to the botanies.—*N. Wittboldii,* F.R. 5:247 (1900); 6:525, is a variety of Boston Fern with fronds thrice as wide as the type. The pinnæ are said to have characteristic convolutions.

L. M. UNDERWOOD.

1476. Nerine curvifolia, var. Fothergilli (× ⅔).

The Boston Fern, *Nephrolepis exaltata,* var *Bostoniensis,* is without doubt the most valuable ornamental foliage plant for house and conservatory decoration that the trade has put on the American market for years. Its many good points made it a welcome addition to our list of plants, and the flower-loving public soon discovered that it was a fit companion for the palms, enduring with them equally well the dry atmosphere of the house. Thriving under indifferent care, it has proved itself a very valuable plant. It grows where many of our best house plants had been failures. It is a plant that can be procured at little cost and is easily grown. It is propagated by division or by the creeping rhizomes. This is best done in early spring. The rhizomes may be pegged down in small pots and when well rooted may be detached from the parent plant. A good compost for potting consists of soil and leaf-mold, with some well-rotted manure added. Shift into larger pots or pans as the plants require. Secure good drainage and give plenty of water, especially during the summer months. This treatment will make specimen plants of 3–5 ft. in diameter by October, with graceful fronds drooping in such a manner as to hide the pot or pan. A well-grown specimen suspended in a bay-window is a sight long to be remembered. There are many plants in good condition that have been in use for several years during the summer on the veranda and in the house during the winter months.

JAMES DEAN.

NEPHTHŸTIS (name borrowed from Egyptian mythology; Nephthys, mother of Amibis, wife of Typhon). *Aràceæ.* About half a dozen species of tropical African creepers, 2 of which are cult. in hothouses for their variegated foliage. The lvs. are all more or less halberd-shaped or arrow-shaped, with scarcely any sheath on the petiole. Inflorescence terminal: spathe concave-expanded: ovary 1-celled; ovule solitary, pendulous.

picturàta, N. E. Br. The white markings form a pattern resembling the tips of fern fronds laid between the nerves, with their points all directed towards the base of the midrib. Plant stemless, spreading by runners: petioles 10–12 in. long: blade 6–12 in. long, 5–9 in. broad. Congo. Var. **angustàta,** N. E. Br., has smaller and narrower lvs. Figured in catalogue of U. S. nurseries 1895.

triphỹlla, Hort. "A pretty stove creeper with dark green thrice-divided lvs. marked with greenish white in the exact shape of the leaf."

NEPTÙNIA plèna is a rare sensitive plant of aquatic habit found in the East and West Indies and S. Amer. It has foliage much like that of the common sensitive plant, *Mimosa pudica.* The fls. are so odd that no one at first sight would imagine that they belong to the legume family. They are more or less egg-shaped in outline, 1½ x 1 in., and borne singly on stalks 6 in. long. They are drooping and have numerous stamens. The singular feature of these fls. is a mass of yellow petalage composed of 6 or more tiers of reflexed, narrowly lanceolate strips, which are really transformed and sterile stamens. The plant floats on the water and has grooved stems, the portion under water being white, spongy and full of air-cells. It is of difficult culture and can probably not be secured in Europe at present, but would make an interesting addition to our northern botanic gardens. B.M. 4695. *Leguminosæ.*

NERÌNE (a nereid of Greek mythology). *Amaryllidàceæ.* A remarkable genus of tender bulbous plants, of which the commonest species is *N. Sarmiensis,* long known as the Guernsey Lily from the island where these bulbs are grown to perfection. They will never become popular with florists, because the winter is their growing season instead of flowering time. They belong to the very small class of autumn-blooming bulbs. The common kinds flower from Sept. to Nov. without any foliage, and the lvs. are developed all winter. About May the lvs. die down and the bulbs rest from May to Aug. The fls. range from scarlet through salmon and pink shades to white, and are borne in umbels of 4–20 fls., on scapes varying from 1–3 ft. long and averaging 1½ ft. The fls. are 6-parted, the segments more or less rolled back and sometimes crimped or fluted.

There are 10 species, all from South Africa. A common trade name is *Nerine Japonica,* which is really a Lycoris since it has black seeds, while all the true Nerines have green seeds. It, however, has the au-

tumn-blooming habit and fls. of the same general appearance as true Nerine. Nerines have two distinct types of beauty, illustrated by Figs. 1476 and 1477. The kinds with the narrow perianth segments, which are crisped or fluted, have a spidery look and are not as popular as the kinds with broad, flat segments, which make a showier cluster of fls. The segments vary from one-twelfth to one-half an inch in width. The showiest kinds are hybrids or varieties of *N. Sarniensis* and *N. curvifolia*, the former species being the most prolific of varieties. In these two species the strong, vertical lines of the erect, long-protruded stamens make a striking feature. The fls. of the other species have more of a drooping tendency and the stamens are shorter and declinate, as in Fig. 1477. *N. pudica* is perhaps the choicest white-fld. kind. Nerines have bulbs 1–2 in. or less in diam., and about 6 lvs., varying from 8–18 in. in length and 4–9 lines in width. Among the uncultivated kinds are some with short, stout scapes and others with appendages at the base of the filaments. The lvs. appear after the fls. in the first two species, but with the fls. in the others. Baker, Handbook of the Amaryllideæ, 1888, and Flora Capensis, vol. 6, 1896–7.

The following American experience is condensed from an article by the late John Robertson, in the Florists' Review 1:675.

Nerines are noted for the sparkling texture of their fls. In strong light they have the appearance of being frosted over. No flower with which the writer is acquainted appears to better advantage under artificial light than *N. Fothergilli*, var. *major*.

The secret of success with Nerines is to secure the fullest possible development of the bulbs. This refers to their winter treatment. They enjoy abundance of water at the root and overhead, with occasional applications of liquid manure. This treatment should never cease until the lvs. turn yellow, which is a sign that the plants are finishing their growth. Then diminish the water supply gradually, lay the pots on their sides where they are not likely to get wet, and in full sunlight, so that the bulbs may ripen thoroughly.

Nerines do not like to have their roots disturbed, nor do they require much root room: they grow and flower best when hard pot-bound. Three bulbs planted in good fibrous loam with a little sand may remain in a 5-inch pot for five or six years, or even longer, as the offsets can be rubbed off and separately potted while the parent bulbs go on increasing in size. Each year as the flower-scape appears pick off about an inch of the surface soil with a sharp-pointed stick, and give the ball of roots a good soaking and a slight top-dressing.

INDEX.

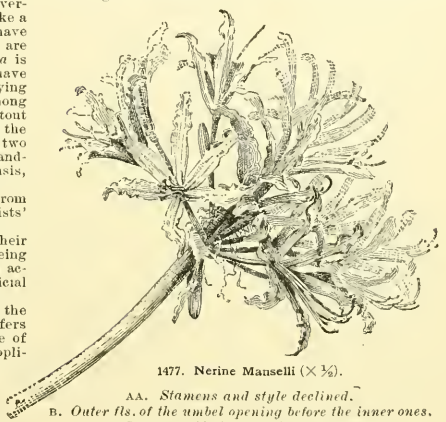
A. *Stamens and style nearly erect.*

B. *Lvs. green, subercct.*

1. **Sarniènsis,** Herb. Guernsey Lily. Lvs. linear, not curved laterally: fls. bright crimson; perianth segments hardly crisped. B. M. 294.—Var. **Plántii,** (*N. Plántii*, Hort.) has a longer scape, duller fls., and more distinctly clawed segments. Gn. 21:329. Var. **venùsta** has bright scarlet fls. produced earlier than any of the other varieties. B.M. 1090 (as *Amaryllis venusta*). Var. **ròsea** has lvs. darker green than the type: fls. rose-red: seeds oblong instead of globose. B.M. 2124 (as *N. rosea*). Var. **corùsca** (*N. coràsea*, Herb.) has bulb tunics not chaffy: lvs. broader than in the type, with distinct cross-bars between the main veins: fls. large, bright scarlet. B.M. 1089 (as *Amaryllis humilis*). Gn. 21:329. *N. corusca major* has rich crimson-red fls. Var. **carnòsa,** Van Tubergen, carmine rosy. Var. **insignis,** Hort. Krelage, is considered by Baker synonymous with the type, but is probably horticulturally distinct. The flowers are said to be rosy.

BB. *Lvs. glaucous, sickle-shaped.*

2. **curvifòlia,** Herb. Lvs. strap-shaped, curved laterally, thicker than in *N. Sarniensis*: fls. bright scarlet: perianth segments hardly crisped. B.M. 725 (as *Amaryllis curvifolia*). R. B. 22:13.—Cult. only in the form of var. **Fothergilli** (*N. Fothergilli*, Roem.), which is more robust in all parts (Fig. 1476): fls. more numerous, between crimson and scarlet. Gn. 22, p. 463. Var. **Fothergilli màjor** (*N. Fothergilli major*, Hort.) is a form with still larger fls. F.R. 1:675.



1477. Nerine Manselli (× ½).

AA. *Stamens and style declined.*

B. *Outer fls. of the umbel opening before the inner ones.*

C. *Segments distinctly crisped or fluted.*

3. **flexuòsa,** Herb. Scape flexuous, longer than in the other kinds, sometimes 2–3 ft. long: fls. generally pale pink. Var. **pulchélla** has glaucous lvs., firmer than in the type: scape not flexuous: fls. pale pink, keeled rose-red. B.M. 2407 and Gn. 21:329 (as *N. pulchella*). *N. flexuosa*, var. *pudica* was offered in 1890 by Reasoner Bros. *N. Mánselli*, O'Brien, Fig. 1477, is a fine hybrid between *N. flexuosa* and *Fothergilli*. Gn. 56:1460.

CC. *Segments hardly crisped.*

4. **pùdica,** Hook. Lvs. 4–6, glaucous: umbels 4–6-fld., the other kinds being 8–20-fld.: fls. white, keeled pink above, ¾ in. wide; stamens a little shorter than the perianth. F.S. 22:2464. Gn. 21:329.—Showy, not spidery.

BB. *Outer fls. opening after the inner ones.*

C. *Length of perianth segments ½–¾ in.*

5. **undulàta,** Herb. Fls. pale pink, very much crisped. B.M. 369 (as *Amaryllis undulata*).

CC. *Length of perianth segments 1–1¼ in.*

6. **hùmilis,** Herb. Scape often smaller than in the other kinds, ½–1½ ft. high: fls. bright pink or rose-red, somewhat crisped. B.M. 726 (as *Amaryllis humilis*). Gn. 21:329.—Var. **splèndens,** Hort. Krelage, is presumably the best form of this species. Fls. purple-crimson.

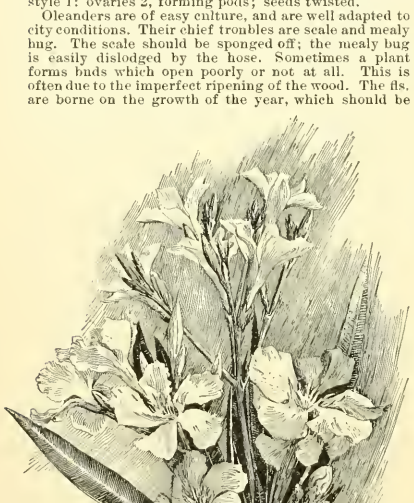
The following names are mostly important hybrids which in many cases are more popular than the species: *N. amábilis* (pudica × humilis), rosy, dark-striped. Var. *grandiflora*, Hort. Van Tubergen, has larger fls.—*N. crispa*, Hort. Thorburn, scarlet.—*N. élegans* (flexuosa × Sarniensis, var. rosea), pink. Var. carmiuata, cerise. Var. cœrulea, shaded blue.—*N. excéllens*, Moore (flexuosa × humilis, var. major), carmine rosy, dark-striped.—*N. Húylocki* (curvifolia × flexuosa, var. pulchella). One of the oldest hybrids in cult. Raised by Wm. Herbert. The others in this list are more modern.—*N. Japónica*, Miq.=Lycoris radiata.—*N. Manselli* (flexuosa × curvifolia, var. Fothergilli), warm pink, late. See No. 3.—*N. Méadowbankii* (Sarniensis × curvifolia, var. Fothergilli).—*N. O'Brieni* (pudica × Sarniensis, var. Plantii). Var. cœrulea, Van Tubergen, pale violet, tinged blue.—*N. tardiflòra*, Hort. Van Tubergen, not accounted for by Baker. Fls. bright red in Dec.

W. M.

NÈRIUM (ancient name for Oleander, supposed to be from Greek *neros*, "moist;" alluding to the places in which it grows wild). *Apocynàceæ*. The Oleander is an old-fashioned evergreen shrub known to everybody, and cultivated everywhere in southern countries. The Bermudas, especially, are famous for their Oleander hedges. In the North the Oleander is a common house plant, being grown in tubs for summer decoration, and ranking in popularity after the sweet bay and hydrangea. It attains 7–15 ft., and blooms in summer, the fls. being salver-shaped, 5-lobed when single, 1½–3 in. across, and commonly pink or white, though the colors range from white through creamy white, blush, rose and copper color, to crimson and dark purple, with variegated forms.

The genus contains only 2 or 3 species. They are glabrous shrubs: lvs. in whorls of 3, rarely 4 or 2, narrow, leathery, transversely feather-veined; fls. in terminal cymes; calyx with many glands inside at the base; corolla-tube cylindrical at the base; throat bell-shaped and containing 5 wide or narrow teeth; lobes twisted to the right; anthers 2-tailed at the base and tapering at the apex into a long, thread-like appendage; style 1; ovaries 2, forming pods; seeds twisted.

Oleanders are of easy culture, and are well adapted to city conditions. Their chief troubles are scale and mealy bug. The scale should be sponged off; the mealy bug is easily dislodged by the hose. Sometimes a plant forms buds which open poorly or not at all. This is often due to the imperfect ripening of the wood. The fls. are borne on the growth of the year, which should be well ripened in June in order to set many strong buds. For this purpose give the plants plenty of light and air, and water more sparingly when the vegetative growth seems to be finished. After flowering, give the plants less water. Protect them from frost in winter; keep them, if necessary, in a light shed. In April, prune back the old wood which has borne fls. and give more warmth and water. The ripened leading shoots can be rooted in a bottle of water. Oleanders are poisonous, and some people have died from carelessly eating the fls. Cattle have been killed by eating the foliage. E. S. Miller writes: "We have good success in rooting ripe wood in the winter. The cuttings remain 3 to 4 weeks in the sand, with moderate bottom heat. They grow like weeds when potted." W. M.



1478. Spray of Oleander—Nerium Oleander.

Oleanders in the East.—The Oleander is becoming somewhat fashionable again, especially the double-flowered variety of cerise color. The following method of Oleander culture has been pursued by the writer with success. Propagation is performed after the flowering period. Good-sized cuttings are taken, and every one grows. When rooted, the cuttings are potted in small pots and kept barely alive over the winter. They will need scarcely more attention than geraniums until February or March, or whenever growth becomes more active. Later in the spring the young Oleanders are planted outdoors in the open ground, in good rich loam or garden soil. (This is sometimes done with ivies or euonymus, but the common method is to plunge the pots outdoors during summer). Take up the Oleanders in September, pot them and bring them indoors for their second winter. The following spring the plants will bloom, but they will not be shapely. The time has now arrived to train them, either as bush plants or crown standards. Top them at whatever height is desired, say 2 or 3 feet, and the plants will make good crowns the same season (i. e., their second summer). Do not allow the plant to bloom the following spring, (which is its third spring), and the result will be a fine specimen in full flower for the fourth summer.

H. A. Siebrecht.

Oleanders in California.—Oleanders are much grown in S. Calif. and would be extremely popular were it not for black and other scales, which seem to prefer them to everything else. We have five colors here, perhaps all of the same species—white, light pink, dark pink, scarlet and buff. Most of these colors, if not all, can be had in both single and double forms. The writer has never seen an Oleander more than 15 ft. high, but he believes they will grow larger. One Los Angeles man planted the red variety thirteen years ago for sidewalk trees. (For this purpose, if cleaned of scale when necessary, the Oleander is one of the very best.) The trees are heavily pruned and topped each year. They are now 12 ft. high and 4–5 in. in diameter at base. Oleanders need no attention here, and are as readily propagated from hardwood cuttings as willow. They are very floriferous, and the inflorescence comes out in large, heavy heads, necessitating a close pruning to make them self-supporting. Ernest Braunton.

A. *Fls. not scented.*

Oleánder, Linn. Oleander. Rose Bay. (Another plant called Rose Bay is *Epilobium angustifolium*.) Fig. 1478. Lvs. in 2's or 3's, lanceolate: appendages of the anthers scarcely protruding: segments of the crown 3–4-toothed. Mediterranean region, Orient. Gn. 51, p. 81 (fine trees in vases). A.F. 10:265 (Bermuda shrub with a spread of 25 ft.). L.B.C. 7:666 (var. *Loddigesii*, with a variegated fl. and the appendages entire, ovate and obtuse). *N. album*, *atropurpureum*, *carneum* and *roseum*, Hort., are doubtless varieties.

AA. *Fls. scented.*

odòrum, Soland. Sweet-scented Oleander. Lvs. in 3's, linear-lanceolate: appendages of the anthers protruding: segments of the crown 4–7, long and narrow. Persia, India, Japan. B.R. 1:74. B.M. 1799 and 2032.—A less robust plant, with lvs. commonly narrower and more distant, and angled branches. In wild plants the calyx-lobes of *N. Oleander* are spreading; of *odorum* erect. Not advertised but cult. Has some range of color and single and double forms. W. M.

NERTÈRA (Greek, *lowly*: referring to the habit). *Rubiàceæ*. The Bead, or Coral Bead Plant (*N. depressa*) is a hardy perennial Alpine or rock plant which forms a dense mat of foliage covered with orange-colored, translucent berries the size of a pea. The genus com-

prises 6 species of similar habit found in the mountains of the southern hemisphere. The best of the genus, probably, is *N. depressa*, which ranges throughout the Andes, from the tropics to Cape Horn. It also inhabits Tristan d'Acunha, and the mountains of New Zealand and Tasmania. The Bead Plant is prop. by seed or division. It needs a sandy soil, with some leaf-mold, and prefers shade in summer. It may need some winter covering in the North. It makes a good house plant and well-fruited specimens are occasionally used abroad in fancy hedding as a novelty. The fruit may last from midsummer well into the winter.

Nerteras are slender creepers, with small, opposite lvs. which are stalked or not, ovate or ovate-lanceolate; stipules grown into a sheath with the petioles, 2-dentate or entire: fls. axillary, inconspicuous, sessile; corolla 4-lobed; stamens 4: ovary 2-celled; drupe 2-seeded.

deprèssa, Banks and Soland. Almost glabrous: stems 6–10 in. long, 4-cornered: lvs. 2–4 lines long, broadly ovate, acute or obtuse, leathery or almost fleshy; petioles about as long as the blades; stipules very small: fls. solitary, greenish. F.S. 21:2167 (charming). B.M. 5799. W. M.

NESÆA. See *Decodon.*

NETTLE. *Urtica.* **Dead N.,** *Lamium.* **False N.,** *Bæhmeria.* **Tree N.,** *Celtis.*

NEVADA, HORTICULTURE IN. Fig. 1479. The northwestern part of the state along the eastern slope of the Sierra Nevada mountains is the chief fruit section. In the southern part of the state, which is also near the Sierra Nevada mountains, some very fine semi-tropical fruits are grown, but lack of transportation facilities prevents their more extensive production as yet.

There are possibly 1,500 acres planted in apple trees, a great many of these being young trees, not yet in bearing. As to other fruits, the acreage planted is small, as they can be sold only in our home market, which is very limited. Some of the largest apple orchards contain 30–50 acres each. An orchard of 30 acres in full bearing would produce about 6,000 boxes of marketable apples, worth here $1 per box; the expense of everything connected with them would be about $1,000.

All fruit and other crops require irrigation. The water for irrigation is obtained from rivers and creeks, and sometimes from reservoirs. The water is sometimes run all over the ground and sometimes in furrows.

Black, sandy loam with a granite base appears to be the best soil for apples, pears, plums, raspberries and strawberries. Some kinds of fruits, such as peaches, plums, prunes, strawberries, etc., do well in more compact soil derived from slate and volcanic rocks All Nevada soils are well supplied with iron, and some have a very high percentage of potash. An elevation of from 4,000 to 5,000 feet seems best for hardy fruits. The price of good orchard land is about $200 per acre, and of bearing orchard about $500 per acre; this includes water.

None of the fruit is subject to injury in winter; the only time it is liable to injury is in May, when the trees are in bloom.

The San José scale has appeared in a few places. The woolly aphis and green lice are sometimes troublesome on young trees and grafts. The codlin moth also is present in some places.

Of apples the following are cultivated: Newtown Pippin (both yellow and green), York Imperial, Spitzenburg, Jonathan, Pilot, Smith Cider, Wagener, Buckingham, Grimes Golden Pippin, Northern Spy, Wine, Wine Sap, Strawberry, Rome Beauty, Ben Davis and Pioneer. Other kinds of fruit are grown only for the local market, and their production is very limited. No new varieties seem to have originated in the state as yet.

Ross Lewers.

1479. Nevada.

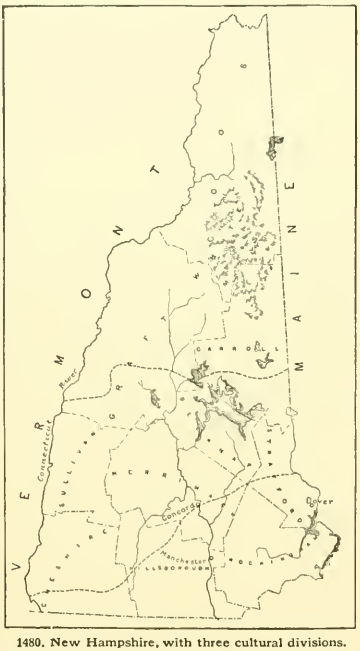
NEVIÙSIA (after Rev. R. D. Nevius, who discovered it.). *Rosàceæ.* This is a very rare shrub which grows wild only on some shaded cliffs near Tuscaloosa, Ala. It is, however, quite hardy as far north as Philadelphia. Its long, slender, wand-like branches remind one of Kerria, but it has no petals, and its beauty is after the Spiræa kind. The fls. are about an inch across, 6 or 8 in a cluster, and the clusters strung along 2 or 3 ft. of wand-like stem, forming ropes of feathery bloom. This fringe-like beauty is caused by the numerous white filaments of the stamens. Botanically this genus is a puzzle, but it is probably nearer Rubus than Spiræa. Generic characters are: calyx-tube small, flattish, persistent; lobes 5, large, spreading, leafy, serrate, imbricate; petals 0; stamens in many series, persistent; disk flattish, enclosing the calyx-tube; carpels 2–4, small, sessile, silky; styles incurved at the apex; ovules solitary, hung from the top of the cell: akene drupaceous, small, included by the ample calyx.

Alabaménsis, Gray. Snow Wreath. Height 3–7 ft.: lvs. alternate, petiolate, 1½–3½ in. long, pale green, ovate or oblong-ovate, usually doubly serrulate; petioles 3–6 lines long. B. M. 6806.—Alfred Rehder writes that it is hardy at the Arnold Arboretum (at least in a sheltered position), and blooms every year.

NEW HAMPSHIRE, HORTICULTURE IN. Fig. 1480. Horticulture in the Granite State began almost with the first settlement. In 1623 Ambrose Gibbons set

the first vineyard, together with other fruits, near the mouth of the Piscataqua river, now Portsmouth. There are many such old horticultural landmarks.

The native fruits are only too abundant in the state at the present time. The old idea that the destination of the apple was the cider barrel got so strong a foothold in some sections that, as the virgin soils began to



1480. New Hampshire, with three cultural divisions.

decline and the wheat crop and its associates in agricultural operations moved on to the West, it was not thought worth while to adopt modern methods of fruit-growing. In other sections, however, quite the reverse is true, as there are signs of awakening at later dates. Some towns are noted for their large areas of old orchards still in bearing but rapidly declining. In one town where from 20,000 to 30,000 barrels of apples have been shipped in a fruit season, the industry has now nearly run out. However, the land containing these old trees is, it is said, worth twice as much as other land. Comparatively few new trees have been set in this section, and it is found that the whole industry is the result of one man's interest and labor two generations ago.

In some places grafting the native apple trees to Baldwins or the improved fruits has been very extensively practiced, with good results. Where this has been done, however, the trees are now old, and as cultivation and renovation of orchards have scarcely ever been practiced, they are naturally on the decline.

While these conditions are not flattering, they nevertheless show what must be overcome in the future. However, it is surprising to see what a quantity of fruit is raised in favorable seasons, and this goes to show that under intelligent and progressive management success will be assured.

At present the horticultural interests are gradually being better understood, and the trend has begun in the right direction. There are many things accountable for this awakening. The people are coming to realize that there are newer and better methods, and that the new agriculture stands for more business and energy. The development of this condition is coming through the efforts of the grange, experiment stations, the agricultural press, State Board of Agriculture, and agricultural teaching in state colleges,—all of which have in the main the same objects in view.

Here and there young orchards are being set, and the predictions are that the near future will find New Hampshire as one of the best fruit states. The Baldwin apple is the standard variety throughout the southern part of the state. In the northern part of the state the Bethel is being planted and, it is thought, will be to this section what the Baldwin is to the other. Almost all other varieties common to New York are grown with equally good success. Even in the White Mountain region it is being demonstrated that orcharding is a worthy industry. A list of apples adapted to the northern part of the state, named in order of their ripening, as furnished by Mr. J. D. Howe, of Lancaster, a large fruit-grower, is as follows: Yellow Transparent, Tetofsky, White Astrachan, Red Astrachan, Peach, Duchess of Oldenburg, St. Lawrence, Alexander, Fall Jennetting, Fameuse, Wealthy, Nodhead, Porter, Talman Sweet, Gideon, Bethel, McIntosh Red, Twenty Ounce, Yellow Bellflower, Northern Spy, Stark and Ben Davis.

Pears and plums do very well generally throughout the state. Peaches do fairly well in the southern part. During 1897 and 1898 there was a very fine crop. The varieties of greatest value are Mountain Rose and Early Crawford. Small fruits generally are easily grown in the state.

The wild grapes found quite commonly on the stone walls and hedges in the southern part of the state are not the native varieties, but wildings showing indications of *Vitis vinifera* blood. Many of them are very palatable and valuable.

New Hampshire has many advantages for horticultural work. The markets are usually good and within easy access; and the great number of summer boarders also makes a ready market. It is also within easy reach of exporting stations, which in seasons of large crops is an advantage.

F. Wm. Rane.

New Hampshire is a small state, and may well be called a land of horticultural possibilities rather than achievement. With some of the best markets in the country within a day's journey, and the rapid extension of electric railroads, both in mileage and usefulness, there seems no good reason why all the hardier kinds of fruit may not be raised at a profit.

The southern half of the state is hilly but can hardly be called mountainous. Through it run several fertile valleys with excellent opportunities for gardening and small-fruit raising. The uplands produce apples of fine quality even under the present system of neglect, and it would seem that in this whole region commercial horticulture must become more and more profitable and popular, as improved methods of culture are adopted.

The White Mountains cover the greater part of the northern half of the state; here, the entertainment of tourists and visitors in summer, and lumbering in winter will probably continue to be the leading industries, unless rational methods of forest management are too long postponed.

It is recorded that a vineyard and other fruits were set out on the eastern coast of New Hampshire as early as 1623. Doubtless much of this succumbed to the severity of the long winters, and it is the apple alone that stands out preëminent in horticultural history as the fruit of the Granite State. Many of the early settlers came from the southwestern counties of England. To them cider and perry seemed almost as necessary as food, and very soon after their arrival they began to set orchards of apples and pears. Their particular object was not the fruit itself, but the beverages made from it. The following item is taken from one of the many town histories that have been published in New Hampshire, and although it may be slightly exaggerated, it gives some idea of the apple industry one hundred years ago:

"About this time—1800 to 1810—the apple orchards in town which had been early set out, produced apples in abundance, which were made into cider. Every man had his orchard, and every tenth man his cider-mill. Every well-to-do farmer put into his cellar yearly from 20 to 50 barrels of cider which was all drunk on the premises. Col. John Bellows had an orchard of 30 acres, the largest in town. In 1805 there were 4,800 barrels of cider made and every drop drunk in town."

At the present time a good many old and somewhat neglected apple orchards are to be found, and these often bear good crops of marketable fruit. At the annual meeting of the New Hampshire Horticultural Society in January, 1899, it was estimated that $2,000,000 worth of apples were exported from the state in 1898. Of these about one-half were raised in the two southeastern counties—Strafford and Rockingham.

The varieties most commonly grown for export are Baldwin, Rhode Island Greening, Northern Spy, Fameuse, Blue Pearmain, Yellow Bellflower, and King. The newer varieties are of course being introduced, but very few large orchards are being set. Summer and fall apples are abundant for local consumption.

Very little has been done in a commercial way with the drupaceous fruits. Plums are successfully raised on a small scale. The Lombard is undoubtedly the favorite variety, although the Japanese plums appear to be able to withstand the climate, and are rapidly growing in favor.

Peaches are raised in a few somewhat isolated instances, and it is worthy of note that the peach-growers of five years ago are still in the business. The introduction of this fruit as a money crop is of such recent date that records are hard to obtain, but it is estimated that three crops in five or possibly six years is about the average production. Perhaps hardier varieties will be developed as time goes on. The Barnes peach, a New Hampshire seedling, is a step in this direction. Its originator describes it as being "of good size and color, a freestone, with very yellow and solid flesh of fine flavor." "It ripens in the southern part of the state about Sept. 10, and is the hardiest in wood and bud of anything yet fruited here."

Market gardening and the raising of small fruits receive some attention, especially in the Merrimac river valley.

Greenhouse gardening is carried on to a limited extent near the larger towns and cities. Flowers receive their full share of attention, but a good many winter vegetables are still imported from the neighboring state of Massachusetts.

The New Hampshire Horticultural Society was organized in December, 1893, and after a year of prosperity was granted an appropriation of three hundred dollars a year by the legislature. This sum enabled the society to hold an annual exhibit in each of the two following years, and also several institutes in different parts of the state. The legislature which met in January, 1897, however, failed to make the appropriation, and the society was compelled to rely upon its officers and members to carry on the work. The annual exhibits were then held in connection with the State Grange Fair.

A department of horticulture was established at the New Hampshire College of Agriculture and the Mechanic Arts, at Durham, in 1895 and has grown in both usefulness and influence.

With the two last-named powers for good, working for the advancement of horticulture in the state, and the fact that emigration from the farms to the cities is rapidly decreasing, if not already reversed, it is to be hoped and expected that within the next decade New Hampshire will rank as a horticultural state, judged not so much by the gross amount of the output, as by the quality of her products, and the intelligence of the producers.

J. A. FOORD.

NEW JERSEY, HORTICULTURE IN. Fig. 1481. The state of New Jersey, situated as it is between the large markets of Philadelphia on the one side and Newark, Jersey City and Greater New York on the other, is almost necessarily a market-garden and fruit-growing state. The soils found in the different sections also contribute to this end. In the northern part, disintegrating sandstone and slaty formations abound—a soil in which the peach does its best. The sandy soils of South Jersey make that part of the state noted for its truck, berries, etc. Between these two classes of soils are found others of all grades, in one or another of which nearly every kind of fruit and vegetable finds a congenial habitat.

It is estimated that there are in New Jersey approximately 34,000 farmers. A little more than one-tenth of these are engaged in commercial pomology—commercial in that they are growing fruit for market, depending on their fruit-product for the money-crop of the farm. Those who have planted larger or smaller areas primarily for home use, yet in good years have a surplus to dispose of, are not included in our data. The total area represented is something over 41,000 acres, including all counties of the state except Ocean, from which no commercial orchards are reported, and gives an individual average of 12¼ acres. This average acreage may be all of one kind of fruit, or it may be two acres each of a half-dozen kinds, as the case may be. Individual acreages range from one acre in the case of berries to 100 and 150 acres for peaches.

The fruit of fruits for the state is the peach. The area devoted to its culture exceeds that of all the other tree and small fruits combined by nearly 100 acres. In the distribution of this area, a little over 83 per cent is found in the five northern or northwestern counties, i.e., Hunterdon, Sussex, Warren, Morris and Somerset,

1481. Horticultural regions in New Jersey.

named in order of importance, though with its present rate of increase Sussex will soon be first in area.

The second fruit in importance is the apple, although the area devoted to its culture is a little less than one-third that devoted to peaches. The other fruits, in order of importance in total areas, are strawberries, pears,

blackberries, raspberries, grapes, currants, cherries, gooseberries, quinces and plums.

These fruits are all grown to a greater or less degree in the different parts of the state, but those mentioned, except peaches and apples, are more largely grown in the southern sections. The central part of the state is the chief apple producer, while the northern, as we have seen, is the peach section. In the accompanying skeleton map (Fig. 1481) the numbers in the county indicate its relative importance in total acreage devoted to fruits, 1 being the largest. The names of the two fruits most largely grown in the different counties is also given. While this well shows the general distribution of the principal fruits, it does not give the chief growing centers for all the fruits, which are as follows (by counties):

Apples.	*Pears.*	*Peaches.*	*Strawberries.*
Monmouth, Burlington.	Burlington, Monmouth.	Hunterdon, Sussex.	Cumberland, Atlantic.
Blackberries.	*Grapes.*	*Raspberries.*	*Currants.*
Atlantic, Cumberland.	Cumberland, Atlantic.	Atlantic, Monmouth.	Burlington, Essex.
Gooseberries.	*Cherries.*	*Quinces.*	*Plums.*
Burlington, Camden.	Burlington, Camden.	Burlington. Cumberland.	Camden, Burlington.

Only in two counties, Burlington and Camden, are all these fruits reported. In Cumberland all are grown commercially except currants and gooseberries, while in Essex the exceptions are blackberries and plums.

The cranberry industry of the state is considered apart from the above fruits. The annual yield is second only to the output of the New England bogs, with an occasional year when it exceeds that of New England. In quality of fruit New England does not bear the palm. Burlington county is the chief center of the industry, though cranberry bogs are scattered throughout the southern half of the state. From 100,000 to 125,000 bushels is the approximate annual yield from Burlington county; Ocean county, from which no other fruits are reported, is second in cranberry-growing, with an annual yield of approximately 30,000 bushels.

The truck industries of the state are large and varied, but confined chiefly to the southern half. Monmouth county is a section producing asparagus and tomatoes, as well as other vegetables in wholesale quantities. As an illustration of the extent of the asparagus industry, the shipment of "grass" from one little way-station amounted in one month to over 100 tons, beside quantities sent by boat from a near-by landing.

The sweet potato is another of Jersey's noted products that is grown in large quantities. They are admitted to be the "sweetest of the sweets."

Vegetable-forcing is a growing industry that is as yet in its infancy. Already there are several plants approaching in size those that have made Arlington, Mass., famous.

The growing of cut-flowers is another horticultural industry that has assumed immense proportions. The northeastern part of the state is the center of this industry. Roses, carnations, chrysanthemums, violets, mignonette and smilax are probably the most important ones grown to supply the trade. To say that the industry is large does not convey the right idea of its extent. The fact that the value of roses alone annually reaches into the hundreds of thousands of dollars will bear out the statement that "the growing of cut-flowers has assumed immense proportions."

A. T. JORDAN.

NEW JERSEY TEA. See *Ceanothus.*

NEW MEXICO, HORTICULTURAL PROSPECTS OF. Fig. 1482. New Mexico includes so many diverse conditions of climate and soil that no statements can be made on horticultural subjects which are applicable to the whole area. Indeed, every valley has its own special features, and the problem of the future is to find or develop such fruits, vegetables, cereals, and forage plants as are best adapted to the several localities, so that each cultivated area may produce a maximum crop of the best quality.

While it is impossible to enter into details within the limits of a short article, it may be said, in brief, that the following zones are well represented and of horticultural importance in New Mexico:

(1) Canadian zone: at about 8,000 to 9,000 feet. Cereals can be cultivated successfully, and good pasturage is found; but fruit trees, with one or two possible exceptions, will not withstand the cold. Irish potatoes do very well in this zone. In this zone crops are often grown without irrigation, as on the Sacramento mountains in Otero county.

(2) Transition zone: at about 7,000 feet, as at Santa Fé. The deciduous fruit trees and all sorts of small fruits do admirably. Corn also does very well, and sugar beets have been grown with much success.

(3) Upper Sonoran zone: at about 5,000 to 6,000 feet, as at Albuquerque. Sweet potatoes and the European grapes do very well, and the deciduous fruit trees are largely grown. This is a good peach region, but apples are less profitable than formerly, owing to the abundance of the codlin moth, which increases very rapidly owing to the warm climate.

(4) Middle Sonoran zone: somewhat lower than the last, as in the Mesilla valley and at Deming. Horticulturally, this resembles the last, but its native products resemble those of the Lower Sonoran. (See American Naturalist, April, 1900.) Cotton can be grown, but is not considered as a possible source of profit.

T. D. A. COCKERELL.

New Mexico lies altogether above the altitude of 3,000 feet. Some cultivated valleys, in which many fruits and vegetables succeed, are as high as 7,000 feet. This is the altitude of Santa Fé, where gardening and orcharding are successful. It is mostly a country of mountains and mountain valleys. The mountains reach to 14,000 feet. The average height of New Mexican valleys and arable areas probably exceeds 5,000 feet. While the territory is very large, the area of the mountain districts and of the arid and untillable hillsides is so great in proportion that the lands suited to farming and horticulture which can be irrigated when all water resources are utilized, will not much exceed 2,000,000 acres. A small proportion of this amount is at present in actual cultivation. Of the acreage under cultivation, agriculture claims the larger share.

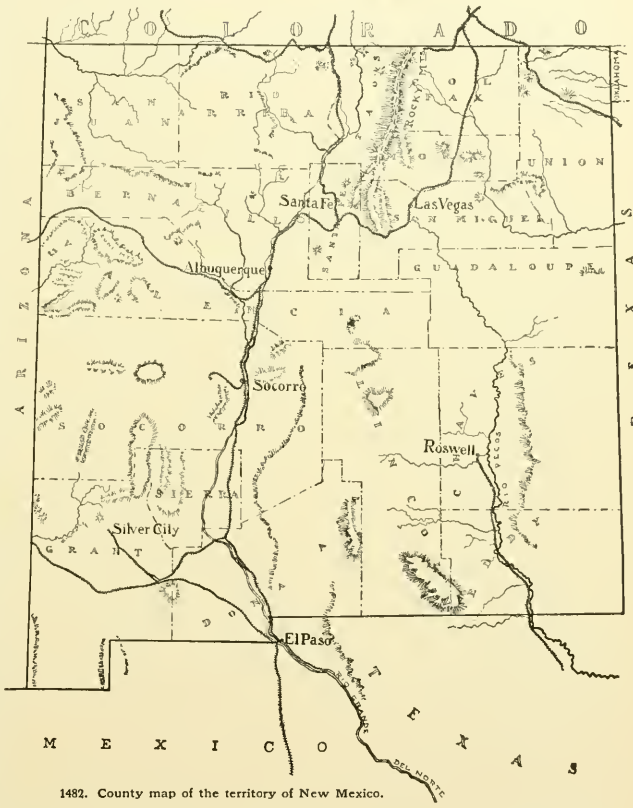
There is a possibility that as much as 500,000 acres may ultimately be devoted to horticultural uses. The preëminent adaptability of these soils, and of this climate, to all the garden, vineyard and orchard crops of temperate latitudes, leads one to hope that the laws of supply and demand will finally consign a large portion of these arable lands to the uses of horticulture. The precise conditions for successful horticultural production are found in narrower areas in America than those that favor common farm crops; hence when the demands of the future American population crowd the resources of supply of the higher orders of human food, it will of necessity follow that the soils and conditions that will yield the largest amounts of the most valuable foods will be devoted to these ends. As this time draws near—a quarter to a half-century hence—the resources of New Mexico for the growth of the most important crops will surely be developed. The soils possess inexhaustible richness of mineral elements, and under good husbandry are permanently fertile. The great average elevation above sea-level gives exemption from most of the destructive plant diseases of humid climates, hence surer, cheaper, better and larger crops. The altitude gives moderate summer temperatures, while the latitude protects against severe winter cold. The grapes of Spain and Italy are grown with little or no protection. In fact, the perfect salubrity of the climate renders horticulture easy in nearly all its branches.

It must be understood that crop-growing in New Mexico is largely dependent on irrigation. There are moderate annual rains, which mostly fall in summer. The average rainfall is about 12 inches. Most of the crops require as much more. The standard of water supply of the irrigation companies is 12 inches. The possible limits of irrigation farming in the old states are very narrow.

Stated in brief terms, irrigation costs money and

energy and some skill, but its rewards are great and sure. The farmer in the rainfall states does well if he makes two acres of land keep one cow or horse or steer summer and winter. Here one acre will carry two animals. In a great measure this applies to the crops of the garden and the orchard. There need be no droughts nor floods; the land can be made to do its full duty every season. There is no doubt that the average weight of garden and orchard crops in any ten years under wise irrigation will be twice as great as in most regions in which it is considered unnecessary or impossible. Hence it seems that within the limited districts of the semi-arid belt of the United States that are susceptible of irrigation, there is an important field for the horticulturist. In this field he will find his greatest rewards. Lands in horticultural crops will produce from two to ten times as much necessary human food as lands under the common crops of agriculture. The parts of this continent in which irrigation horticulture is possible is but a small fraction of the whole area. New Mexico has probably a larger proportion of irrigable lands adapted to horticultural use than any of our states or territories.

All garden crops succeed well in all parts of New Mexico where water can be commanded for the land. All orchard crops succeed admirably in some parts of the territory, and the most important of all, the apple, is a successful crop in nearly all parts. In that portion of the territory lying on the eastern slopes of the Rocky mountains, in the counties of Lincoln and Chaves, the apple seems to reach its most perfect development. There are beautiful apples without blemish grown in many parts of the arid west and along the Pacific coast; but in too many cases the fruit is disappointing in quality. But in the counties named all varieties of apples that have been fruited show a very high apple quality. The freedom from defect is remarkable, and the unexampled beauty of color and clear complexion in bushel after bushel as they come from the trees is a constant surprise. The Yellow Bellflower and Newtown Pippin reach great perfection.



1482. County map of the territory of New Mexico.

In most of the old apple-growing states, the apple is subject to many insects and diseases. In the arid region of the country we have escaped many of these evils. While we shall not escape all the troubles of the orchardist, yet the elevation of the country, the control of the water supply, the purity and dryness of the air and the everlasting sunshine will combine to protect from those serious evils born of humid climates and low altitudes, or that result from weather conditions where man has destroyed the delicate balance of the seasons by the widespread destruction of native forests. It is apparent to some of us that this wide, high region, which never had great areas of forest to be destroyed, possesses more permanent conditions of successful fruit-growing than are possible in any country where the vicissitudes of flood and drought, of great cold and great heat, are the inevitable associates of the year. PARKER EARLE.

In New Mexico the apple grows very well. The counties of Chaves and Lincoln in the southeast, San Juan and Santa Fé in the north, and Grant and Doña Ana in the south, are well known for their fine apples. Four varieties from Mesilla Park, in Doña Ana county, received second premium at the World's Exposition, in Paris, 1900. The following are the varieties: Ben Davis, grown by Frank Burke; Missouri, Pippin, grown on the famous Woodland Orchard; and the Gano and Lawver, from the Agricultural college. At present the apple is free from the common diseases. The only insect enemy is the codlin moth, which in some sections is coming to be a serious pest. The early varieties, such as the Red June, Red Astrachan, Early Harvest and Yellow Transparent, are almost free from the codlin moth, while on

the other hand the late kinds, and especially the winter apples, are more largely attacked by this insect.

The pear grows as well as the apple, but not in such large areas. In most of the apple-growing sections the pear can be found in very limited quantities. However, there is a bright future for a more extensive cultivation of this fruit, as wherever it thrives it grows to a large size, and is fine in quality. The pear blight, which is so bad in other states, is not in the way of pear culture in New Mexico.

Perhaps the fruit that is second in importance at present is the peach, which is grown with more or less success throughout the territory. In the agricultural districts of southern New Mexico the large commercial peach orchards are located, and the Mesilla valley, on the lower Rio Grande, has the most and largest of them. From this valley many car-loads of early peaches are shipped to the markets of Chicago, Kansas City and Colorado. The early-ripening kinds, such as the Alexander, Waterloo, Hynes Surprise, are the most successful. This is due to the fact that, as a rule, the early-ripening peaches bloom later than the late-ripening varieties, and thus they escape the late spring frosts, which are so common in this territory and which are often so fatal to the late peaches. The late spring frost is the worst drawback to peach-growing in New Mexico. No diseases or insect pests have yet threatened the peach crop.

While the apricot grows as well as the peach, and has no insect enemies or fungous diseases, it has failed to be a commercial success on account of its blooming too early. If some late-blooming variety could be found, this fruit would, no doubt, be one of our best fruits to grow. The trees grow to a great age. There are many apricot seedlings on the lower Rio Grande that were planted by the Mexicans forty or fifty years ago.

The plum is making a place for itself in New Mexico. It has been but a comparatively short time since plums were considered to be of any importance, and even now the areas planted to plum trees are very small. However, conditions are changing, and there is a growing demand for them. The plum tree seems to be perfectly hardy in this climate. The Japanese plums are vigorous growers, but are not a success owing to the liability to late spring frosts. Their fruit buds seem to be stimulated to growing during the warm spells in February and March, and thus they bloom before the danger of frost is over. On the other hand, the *Prunus domestica* and *Prunus Americana* varieties are, as a rule, late bloomers. The former group is gaining in popularity throughout the territory. Imperial Gage, Yellow Egg, Coe Golden Drop, Damson and German Prune seem to be among the best varieties in the northern part of the territory. In the southern part, the above-mentioned varieties, with the addition of the Silver Prune, Clyman, Pond Seedling, Jefferson, and Robe de Sergent, are among the best.

Cherries grow well in the territory, but in the southern part they do not grow as large nor as fine as they do in the northern part.

Quinces and nectarines thrive in many of the horticultural districts, but as yet they are only grown for family use.

Perhaps the distribution of the grape is less extensive than that of the other fruits. Wherever the grape is grown it thrives. The American varieties are not of any commercial value. The fruit is usually small, bunches loose, and vines are poor bearers. The European kinds are a success, and are the grapes grown for market. Their culture is confined to the southern and hotter valleys, and particularly to the lower Rio Grande valley. The varieties planted in the commercial vineyards in this valley are the Mission or El Paso grape, Muscat of Alexandria, and more or less the Gros Colman and Flame Tokay. Other varieties are being introduced. The grape is free from fungous and insect pests. Even the phylloxera has not yet made its appearance. The Mission grape, which has been in cultivation for over a hundred years, shows how free the grape is from any pests. The only thing that injures the vines is the dry, cold winters. In order to obviate this trouble the vines are heeled up with earth 6 to 12 inches above the last year's growth. The stump method of pruning is practiced altogether in the grape culture. Attempts have been made to trellis the vines, but have not been very satisfactory.

The small fruits are grown with more or less success throughout the territory, but as yet they are of minor importance in the horticulture of New Mexico.

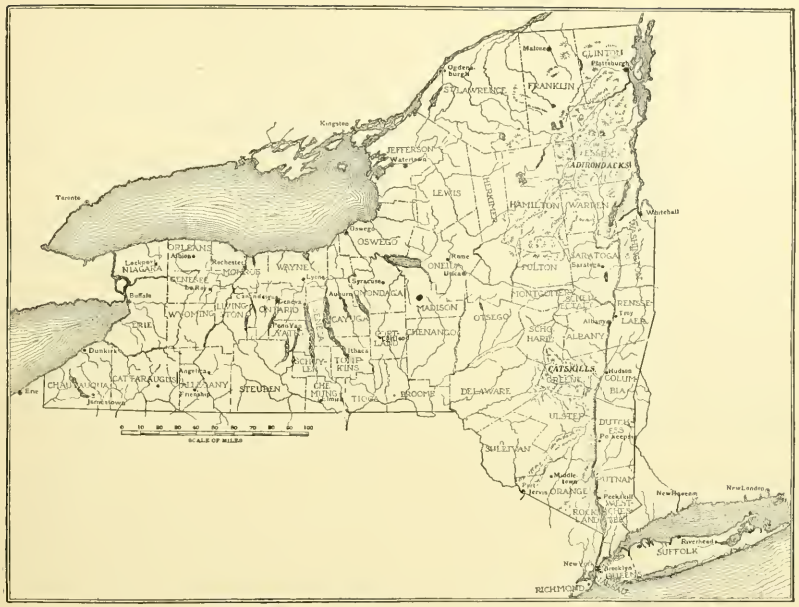
FABIAN GARCIA

NEW YORK, California and Florida may be reckoned as the great horticultural states. In range of species which can be grown, California and Florida excel. California excels in tonnage of many horticultural products. New York, however, excels in the great variety of its commercial horticultural interests, for to its fruit-growing must be added the very extensive nursery business, cut-flower growing, florists' plant-trade, seed-trade, and a great development of the vegetable gardening interests.

In shape and position New York (Fig. 1483) may be likened to a ship sailing westward, its rudder (Long Island) in the Atlantic and its prow touching the Great Lakes. Its commercial preëminence is supreme. A population of more than six million lives within its borders, and a million more are tributary to it in New Jersey and Connecticut. It has more than 40 cities with populations above 10,000. Great variety of soil and surface invites a varied population. Water-power is abundant and unfailing. All this means extensive markets for horticultural produce.

The land area of the state is 30,476,800 acres, of which about one-half is readily cultivable. The state has an extreme length east and west of 412 miles, and north and south of about 310 miles. Excepting a small area in the southwestern part, the entire surface is glaciated. In the northeastern part a true mountain system is shown in the Adirondacks, of archæan formation. In the middle eastern part, the Catskill highlands attain the dignity of mountains, although they are in reality eroded table-lands, having been laid down in the interior sea and subsequently uplifted. These highlands extend westward entirely across the state, being pronounced and almost mountainous in the southern half. The northern part of the western half of the state is relatively level, although the tract from Syracuse to Lyons and westward is marked by very bold drumlins,—the work of the ice-sheet. The bar-beach of the geological Lake Iroquois extends from near Niagara Falls to Oswego, paralleling Lake Ontario at a distance of about 10 miles. This geological beach is a distinct physiographical feature known as "the ridge," and it is the location of one of the notable highways of the state. This ridge marks the southward limit of the best natural peach region. There are fossil beaches on the Erie shore, and these are important to the grape-growing of Chautauqua county. (See Tarr, "Geological History of the Chautauqua Grape Belt," Bull. 109, Cornell Exp. Sta.) Long Island is a moraine, with an ocean-floor formation on its south, and this latter area comprises practically the only flat land in the state.

There are five great watersheds in the state. (1) the St. Lawrence system, draining the Great Lakes and the larger part of central and western New York. (2) The Hudson system, draining the southern slopes of the Adirondacks and the Catskill highlands, with its great tributary, the Mohawk, which, in pre-glacial times, was a part of the St. Lawrence system. (3) The Delaware system, draining a part of the southeastern area into Delaware bay. (4) The Susquehanna system, draining some of the southern-central part into the Chesapeake bay. (5) The Mississippi system, which, by means of the Allegheny river, drains the extreme southwestern part of the state. Chautauqua Lake drains into the Gulf of Mexico, but almost in sight from it is Lake Erie, which flows into the St. Lawrence. Along the Hudson and other large streams, special horticultural interests have developed. The broad Mohawk valley is one of the most fertile parts of the state, and it is the site of the hop and broom-corn industries. The shores of the central New York lakes are the homes of highly developed horticultural interests, particularly those of Keuka and Seneca. These central lakes, of which Cayuga, the largest, is 40 miles long and one to five miles wide, are deep bodies and have great influence in ameliorating



1483. County map of New York State.

the climate in their immediate neighborhood. The shores of Lakes Erie and Ontario conserve horticultural interests,—the former being famous for its grapes, the latter for its strawberries, peaches and apples. Because of its snug winters, there is rarely any starting of fruit-buds by "warm spells," and consequently little danger of loss from spring frosts. The fruit-growing suffers less from frost than it does in the southern states.

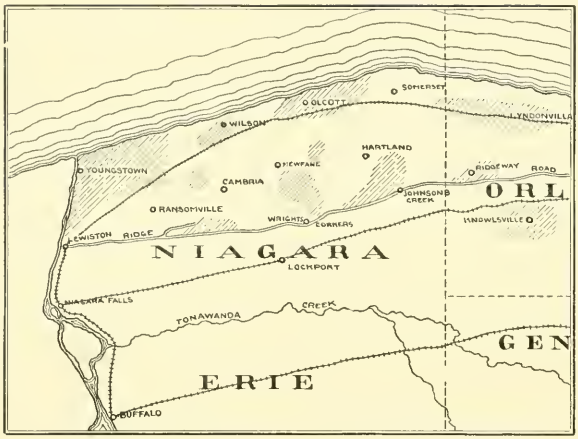
New York contains about 230,000 farms. Agriculturally, the most important industry in New York state (aside from general mixed farming) is dairying. The second industry is fruit-growing, and this seems to be extending more rapidly than the other. The leading fruit is the apple. Nearly all parts of the state grow apples easily, but the great commercial apple-growing regions are the counties of Wayne, Monroe, Orleans, Niagara, with important extensions in Ontario, Genesee and adjacent counties and in Columbia and other east-Hudson counties. A full crop of apples in New York is nearly or quite 7,000,000 barrels. Baldwin is the leading variety, with no varieties which occupy a close second place. Northern Spy, Rhode Island Greening, and American Golden Russet are important commercial varieties. Of late, Ben Davis has been widely planted, but it is probable that this variety will always hold a secondary place in the northeastern states. Until within the last decade, most New York apple orchards have been in sod; but, under the stimulus of rational horticultural teaching, 75 per cent of the orchards in the apple-growing counties are now under a most thorough system of clean tillage. Fig. 1485. Most of these orchards are sprayed. Crops have been heavy in recent years and prices have averaged good; as a result, the apple industry is in thriving condition. The most thorough business methods are employed in caring for the orchards and in disposing of the crop. A large part of the apple crop is exported, although there is a very large business in evaporated fruit.

The grape occupies second place in New York pomology. More than 50,000 acres is devoted to this industry, of which about half the area is in Chautauqua county, lying in a narrow strip against Lake Erie. The other special areas are the central lake region and the Hudson river valley. These three areas stand for three types of viticulture—early and special table grapes for near-by markets in the Hudson valley; staple varieties for wine and grape juice in parts of the lake region (particularly on Keuka lake); general-purpose varieties for distant markets in the Chautauqua region. In the lake region, Catawba is a leading variety. In Chautauqua, Concord far outstrips all others. A normal output of table grapes in New York is about 60,000 to 70,000 tons; of wine between 2,000,000 and 3,000,000 gallons. The grape areas lie close to the lakes or large rivers, thereby receiving the benefit of the ameliorated local climate.

New York is known also for its pears. The apple counties mentioned above, and Oswego, Onondaga, and Columbia counties are the leading pear areas. Bartlett is the staple variety, but Kieffer has risen to near the first place in recent years. The number of commercial varieties, however, is relatively large. The culture of dwarf pears is popular and has reached a high degree of perfection. Thrifty and productive orchards 40 and 50 years old stand in various parts of the state.

The plum is largely planted in western New York, in many varieties. In acreage, Lombard probably leads, but several other varieties excel in commercial importance. The Damsons are largely grown; also the German and Italian prunes (but the latter are not dried). The Japanese plums are now widely planted, and are giving general satisfaction. They are rarely injured by late spring frosts. The improved native plums are relatively little known.

Peaches are grown about all the central lakes and in the Hudson valley, but the only distinct natural peach



1484. Distribution of peach-growing in a part of western New York.
The shaded parts show the chief peach-orchard areas in Niagara and Orleans counties.

region is near the Ontario shore west of Oswego. In the western half of the state, about 10,000 acres are devoted to peach-culture. Fig. 1484.

Apricots are grown with little trouble in the peach regions, and there are several commercial plantations.

Cherries are grown both for the fresh fruit and for canning—the former chiefly in the Hudson valley and the latter chiefly in western New York. The canning cherries are the sour type—chiefly English Morello and Montmorency. The large canning factory industry (some 25 factories in western New York) makes the sour cherry industry profitable.

Quinces are probably more largely grown than elsewhere in the Union.

The small fruit interests are very large, but there are no reliable statistics. In the northern counties of western New York, black raspberries are grown as a farm crop and the product is mostly evaporated. The annual output of dried raspberries five years ago was approximately 1500 tons, but the amount is now less. While the strawberry is an important crop in all parts of the state, it reaches its largest acreage in Oswego county (Fig. 1486), where about 1200 acres are devoted to it. This region supplies the late markets, producing annually about 2,000,000 quarts. In Oswego county there are about 250 acres of red raspberries, mostly Cuthbert. Cranberry-growing has attained some importance on Long Island.

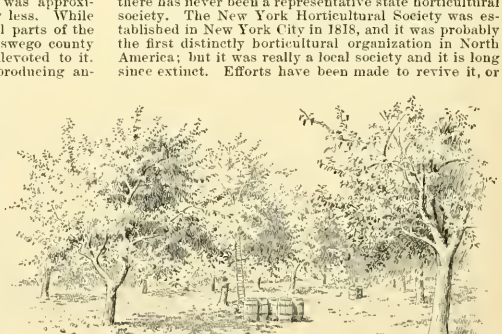
Western New York has long been the center of the nursery business of North America. Of the 4,510 nurseries reported in the United States census of 1890, 530 were in New York. Illinois was second, with 434, and Ohio third, with 393. Not only is the number large, but the variety of stock grown is also significant. Rochester and Geneva are the chief nursery centers, although the stock which is sold in these centers is grown over a wide range of country. In acreage in 1890, New York leads with 24,840 acres, followed by Illinois with 17,812 acres, Ohio 16,790, Nebraska, 15,641, Missouri, 15,190. The total capital invested was nearly $12,250,000 in New York, as against $4,750,000 in Illinois.

In seed-farming, New York stood next to New Jersey, in 1890, in amount of capital invested,—$2,176,076.72 as against $2,333,066.68. In number of seed-farms, Connecticut had 85, New York 78, Tennessee 35, New Jersey 34. The principal seed-crops grown in New York are bush-bean, Brussels sprouts, cabbage, sweet corn, cucumber, kale, onion, pea, turnip, asparagus.

The trucking interests are very large because of the large population and the many means of transportation. The largest single geographical region is Long Island, which, because of its light soil, warm local climate, and accessible location, is one of the leading market-gardening regions of the New World. Long Island has an area of 1,700 square miles, of which the western third is largely devoted to trucking interests. Parts of the eastern end are also trucking areas, particularly for cabbage and cauliflower. Cabbage seed is extensively grown in this eastern extremity of the island.

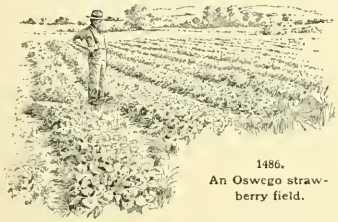
The floricultural interests of New York state are large and growing. Of the 9,000 commercial florists' establishments that Galloway estimates for the United States, not less than 1,100 or 1,200 are in this state, with glass amounting to nearly 4,500,000 square feet. New York city is a market for a large geographical region. As early as 1885, John Thorpe estimated that 4,000,000 roses that were sent to the New York market by nine growers in one year did not constitute half the number sold in that market. The census of 1890 reports the total investment of New York in floricultural business to have been about $9,500,000 (although only 793 establishments are accounted for), as against upwards of 5,500,000 in Pennsylvania, the next heaviest state. The lower Hudson region is the center of the violet industry of the United States. Long Island grows quantities of bulbs.

Because the horticultural interests of New York are separated in more or less distinct geographical regions, there has never been a representative state horticultural society. The New York Horticultural Society was established in New York City in 1818, and it was probably the first distinctly horticultural organization in North America; but it was really a local society and it is long since extinct. Efforts have been made to revive it, or



1485. A New York apple orchard.

rather to organize a new society under the old name, the last effort being made the present year. In 1829, the Albany Horticultural Society was organized, but this also was short lived. The oldest society in the state is the Western New York Horticultural Society, with headquarters at Rochester. The preliminary organization of this society occurred at Rochester, February 27, 1855, under the name of The Fruit Grower's Society of Western New York, to comprise the counties west of Onondaga.



1486.
An Oswego strawberry field.

The late John J. Thomas was the first President. This society, with its one big meeting each winter, is the greatest American organization of its particular type.

One of the earliest experiment stations in North America was organized at Ithaca in February, 1879, as the Cornell University Agricultural Experiment Station. In 1888 this institution was reorganized as a federal station, but previous to this time it had published three reports. The New York Agricultural Experiment Station, supported by the State and located at Geneva, was established in March, 1882. These two stations give considerable attention to horticultural matters, particularly the State Station at Geneva which is located in one of the best of horticultural regions. Each station now receives support from both the state and the federal treasury.

The Agricultural College of New York is a part of Cornell University at Ithaca. It is practically unique amongst agricultural educational institutions in giving courses of true university grade, and its postgraduate courses lead to the degree of Ph.D. Short course instruction of elementary character is also afforded, and the university is the center of a movement for the extension of agricultural knowledge amongst the people.

L. H. B.

NEW ZEALAND SPINACH. Fully treated under *Tetragonia*.

NICANDRA (Nicander wrote on plants about 150 A.D.). *Solanàceæ*. One Peruvian herb differing from Physalis chiefly in the 3-5-loculed ovary and fruit and in the larger and more showy fls. **N. physaloides,** Gaertn., known as APPLE OF PERU, is a strong spreading annual, 3-4 ft. high, grown for the showy blue fls. and odd fruits: glabrous: lvs. elliptic or elliptic-ovate, sinuate and toothed, narrowed into a prominent petiole: fls. solitary in the axils, on recurving pedicels, an inch or more across, shaped like a potato flower: fruit a thin-walled and nearly or quite dry berry, inclosed in an enlarged, strongly 5-winged calyx. B.M. 2458.—The Apple of Peru is an old-fashioned garden annual, now rarely seen. It has escaped from cultivation in some places in the U. S., and it is now widely distributed in the tropics. It is often confounded with the ground cherry and alkekengi, which are species of Physalis. Not advertised.

L. H. B.

NICOTIÀNA (John Nicot was French ambassador to Portugal in the sixteenth century, and was instrumental in spreading a knowledge of Tobacco). *Solanàceæ*. Fifty or more herbs, or one species shrubby, mostly of tropical America. The Nicotianas comprise several stately plants, valued for their rapid growth and large foliage. Other species produce showy flowers, and are popular flower-garden subjects. They are mostly viscid-pubescent herbs of strong odor, and possessing narcotic-poisonous properties. Lvs. alternate, never compound, entire or undulate, mostly sessile or nearly so by a tapering base: fls. long-tubular, mostly opening at night and most fragrant then, in terminal racemes, panicles or thyrses; calyx usually persisting and covering the fr.; corolla salverform or funnelform, the lobes usually plicate in the bud, the 5-lobed border nearly or quite regular; stamens 5, inserted on the tube, generally included, the filaments straight; style single, with a capitate stigma: fr. a capsule, normally 2-loculed, but usually splitting into 4 valves; seeds numerous and minute.

Nicotianas are of the easiest culture. They love a hot exposure, and loose, well-drained soil. They are all tender to frost. For subtropical effects, the seeds (by which they are usually propagated) should be started early under glass. The seeds are so small that they do not germinate well in the open unless the ground is fine and holds moisture near the surface. *N. alata* is the only species which is popularly known as a flower-garden plant, being grown everywhere under the name of *N. affinis*. Of the robust species used for subtropical bedding, *N. glauca*, *N. tomentosa* and forms of *N. Tabacum* are best.

L. H. B.

Nicotianas are tropical herbs requiring in northern latitudes a deep, loamy, rich soil and full sunlight. The soil should be especially rich in lime and potash, both of which may be supplied by the addition of wood ashes. Nicotianas will not grow well in very moist or poorly drained soils. In cool weather the seeds germinate slowly, so that when it may be desired to raise the plants outdoors in early spring the seeds should be "sprouted" before sowing by keeping them moist and warm until growth may be seen. The method generally pursued in northern tobacco-growing regions is to mix the seed, about April 1, with very fine rotted apple tree wood (apple wood is preferable to others, as it contains less tannin, which would be destructive to germinating seeds), and to place the mixture after moistening in a glass jar, and seal. The jar is then placed in a temperature of 80° to 90° until the seed is seen to be germinating, which should be in from four to six days. The seeds are then sown in frames covered with cloth or glass and rolled in with a light roller, or simply pressed

1487. Nicotiana alata.

in with a board. Another method of sprouting the seed is to spread it on a thin cloth stretched over a vessel of water placed where it will be continually warm. When very young, Nicotianas will endure severe frost, which property they lose with age, becoming quite sensitive to

frost when mature. Nicotianas are well adapted for culture in pots or tubs, and are then fine plants for summer porch decoration. F. W. Barclay.

A. *Fls. yellow or yellowish white: lvs. distinctly petioled.*

B. *Plant glabrous and glaucous, becoming woody* (*N. rustica* is not to be sought here).

glaùca, Grah. Becoming 20 ft. high and tree-like in its native place (Argentina), glabrous, glaucous-blue all over and sometimes developing purplish tints: lvs. large, ovate, sometimes subcordate, more or less repand, the petiole conspicuous: fls. in a loose panicle, tubular and constricted below the very short limb, curved, 1–2 in. long, greenish at first but becoming yellow, soft-pubescent on the outside. B.M. 2837.—Not uncommon in cult. for its striking glaucous-blue foliage and stately habit; also run wild in Texas and S. Calif. Usually does not bloom in the northern states. Easily grown from seeds.

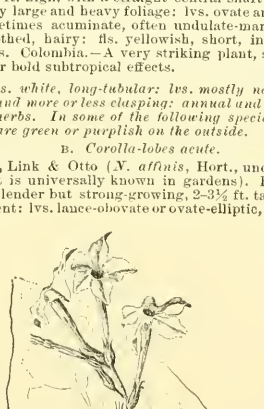
BB. *Plant pilose, herbaceous or half shrubby.*

wigandioides, Koch & Fint. Tall-growing, reaching 6 and 7 ft. high, with a straight central shaft and bearing very large and heavy foliage: lvs. ovate and pointed or sometimes acuminate, often undulate-margined but not toothed, hairy: fls. yellowish, short, in drooping panicles. Colombia.—A very striking plant, sometimes used for bold subtropical effects.

AA. *Fls. white, long-tubular: lvs. mostly not petioled and more or less clasping: annual and perennial herbs. In some of the following species the fls. are green or purplish on the outside.*

B. *Corolla-lobes acute.*

alàta, Link & Otto (*N. affinis,* Hort., under which name it is universally known in gardens). Figs. 1487, 1488. Slender but strong-growing, 2–3½ ft. tall, viscid-pubescent: lvs. lance-obovate or ovate-elliptic, becoming



1488. Nicotiana alata (× 1·5).
Commonly known as *N. affinis.*

small and narrow above, clasping and sometimes decurrent, entire or remotely repand-dentate: fls. remote in a wand-like raceme, spreading, the very slender tube 5–6 in. long, the limb oblique and 2 in. or more across, the narrow-pointed lobes unequal. Braz. G.C. II. 16:141. Gn. 34, p. 520; 42, p. 126; 50, p. 212; 56, p. 384 Gng. 5:182. B.R. 19:1592 (as *N. Persica*).—A deservedly popular plant, blooming freely all the season, until killed by frost. It is well to plant it in a place which is protected from strong winds. It is apparently perennial, but is treated as a tender or half-hardy annual. It self-sows, and often maintains itself from year to year in the Middle States and South. In the warmer parts, the roots live over winter with a little protection. Fall-sown seedlings make excellent pot-plants for the window. The fls. open at night-fall, but close in the daytime. At night they are very fragrant. During the last ten years the plant has become very popular.

Var. **decúrrens** (*N. decúrrens,* Hort.) is lower, branching near the base, very floriferous.

sylvéstris, Spegaz. Fig. 1489. Lvs. larger and better than in *N. alata,* rugose and veiny, more prominently undulate, the stem well furnished near the ground: fls. large, hanging in whorls or fascicles in a heavy large panicle, in shape like those of *N. alata* but the limb less oblique and the tube more swollen, and not closing in the morning or on cloudy days. Argentina. Gt. 47, p. 130. G.C. III. 26:357.—One of the novelties of 1899 and 1900.

longiflòra, Cav. Erect, 2–3 ft., slender, the prominent foliage radical: lvs. oval-lanceolate to lanceolate, prominently undulate, pointed: fls. 4 in. long, the tube green or purplish, but the limb (lobes about ½ in. long) white at least inside, borne in simple racemes. Argentina.—Little known in cult., being inferior to *N. alata.* The flowers open late in the day. Perennial, but annual in gardens and in northern countries.

BB. *Corolla-lobes obtuse or rounded.*

suaveòlens, Lehm. (*N. undulàta,* Vent. *N. longiflòra,* var. *undulàta,* Voss). Variable: 1–2 ft., annual or biennial, usually viscid: lower lvs. long-stalked and ovate or spatulate, the upper ones narrow and sessile and sometimes clasping, all undulate-margined as a rule: fls. in loose terminal racemes, on slender pedicels, salver-shaped, the narrow cylindrical tube about 2 in. long, the circular limb 1 in. or less across, pure white (or greenish outside). Australia. B.M. 673. Gn. 21, p. 291.—The broad lobes usually overlap, so that the limb often appears as if entire. Sweet-scented at night. Plant pubescent or glabrous. Not rare in gardens. It is said that it will endure moderate shade.

noctiflòra, Hook. (*N. longiflòra,* var. *noctiflòra,* Voss). Very like the last, and perhaps a geographical form of it: lvs. lanceolate-undulate: fls. often purplish outside but white within, the spreading lobes notched or emarginate: plant very viscid. Argentina. B.M. 2785.—A night bloomer, like the last. There is a var. **albiflòra,** with pure white fls.

AAA. *Fls. distinctly colored (usually with shades of red), the tube relatively broad or even inflated: annual and perennial herbs.*

B. *Lvs. stalked.*

rústica, Linn., was cult. for Tobacco by the Indians and is run wild in many places, but its nativity is unknown (probably indigenous to the Old World, according to Gray): annual, usually not over 3 ft. tall, viscid-pubescent: lvs. large, ovate and obtuse: fls. yellowish or greenish, 1 in. or less long, the base narrow, tube thereafter inflated, orifice contracted, the lobes short and rounded. The fls. are open by day. Inflorescence panieulate.

BB. *Lvs. sessile and decurrent.*

Tabácum, Linn. Tobacco. Tall, strong-growing striking plant, 3–5 ft., annual, usually glutinous: lvs. mostly ovate or ovate-lanceolate, acuminate-pointed: fls. 2 in. long, rose or purplish, in a large nearly naked panicle, the tube swollen upwards and the spreading lobes pointed. S. Amer.—Cult. from earliest times by the Indians, and occasionally run wild. Its commercial cultivation for Tobacco is an agricultural subject, and therefore is not discussed in this work. It is a striking plant in the garden. There are several forms cult. for ornament, those with large red fls. being most known. *N. grandiflorum, N. purpureum,* etc., are names given to these forms. The fls. are diurnal. See Fig. 1077, p. 757.

tomentòsa, Ruiz & Pav. (*N. colóssea*, André). Perennial, rarely blooming in the North, but easily propagated by cuttings and treated as a tender annual: 8 to 10 ft. and more, very stout and branchy, viscid-pubescent: lvs. obovate-oblong and acuminate, narrowed to clasping and decurrent base, 1–3 ft. long, pale and reticulate beneath: fls. short, the tube inflated at the top and slightly curved, pubescent, the lobes ovate and obtuse and nearly

1489. Nicotiana sylvestris (× ¼).

or quite equal, the color of the tube pale green and of the limb yellowish outside and pale rose within. Brazil. B.M. 7252. G.C. III. 9:83. Gng. 1:97. A.G. 11:117.—A most remarkable plant for large and rapid growth. Very useful in making subtropical effects. The plants came up in soil in which Brazilian orchids were shipped to France, and it began to attract general attention in France about 1889. It usually has reddish stems, thereby adding to the bold effect. Seeds should be started under glass. There is a var. **variegàta, Hort.**, with mottled and margined foliage. R. H. 1893, p. 9. G.M. 37:61.

N. acuminàta, Hook. Slender: lvs. petioled, broad-lanceolate, acuminate: fls. long-tubular, with small obtuse lobes, white. Argentina. B.M. 2919.—*N. fràgrans*, Hook. Three to 4 ft.: lvs. sessile, obovate or spatulate: fls. with very long, slender tubes (as in N. sylvestris) and a large spreading regular limb with emarginate lobes, white. New Caledonia. B.M. 4865.—*N. Làngsdorfii*, Schrank. Two to 3 ft., viscid: lvs. sessile, oval or ovate: fls. trumpet-shaped, the tube enlarging at the top, the limb flaring and nearly entire, yellowish green. S. Amer. B.M. 2221, 2555.—*N. paniculàta*, Linn., from S. Amer., is allied to N. Langsdorfii, but is smaller and all the lvs. are stalked.

Several Nicotianas are native to the Texan-Californian region. One, *N. quadrivàlvis*, Pursh, B.M. 1778, is native as far north as Oregon, and was cult. by the Indians for tobacco. L. H. B.

NICOTÙNIA is a name given by the undersigned to hybrids of Nicotiana and Petunia offered in 1893. They were originally described as follows: "The plants have slender, drooping or trailing tomentose green, red and purple stalks and leaves twice or three times as large as the Petunia; the flowers are handsome, white, pink, carmine or striped and borne in plenteous profusion. No seed is ever produced, but they are very readily multiplied by cuttings."

These plants have unfortunately vanished from cultivation. They were, of course, annuals. They were semi-trailing plants, the leaves covered with abundant short, woolly hairs. The cross was *Petunia hybrida*, var. *grandiflora* × *Nicotiana wigandioides*, var. *rubra*, the former probably being the seed parent. The singular thing about the cross was the fact that the root seemed in all cases to be paralyzed and very defective, though the tops in all the many hybrids produced grew with much vigor. The blooms were beautiful, and it is a pity that the plants were not grafted on tobacco roots.

LUTHER BURBANK.

NIDULÀRIUM (from Latin *nidus*, a nest). *Bromeliàceæ*. About 15 Brazilian epiphytes, by some referred to Karatas and other genera, but by Mez (DC. Monogr. Phaner. 9) kept distinct. The flowers are perfect, borne in simple or compound heads, the petals joined at the base and not ligulate (in all the typical species): anthers attached mostly on the back (in some related plants attached mostly at the base). Leaves strap-shaped, ovate or oval, in dense rosettes, the flowers mostly sessile, red, blue, or white. The inner leaves of the rosette, here called bract-leaves, are usually highly colored and constitute most of the merit of some species. Warmhouse plants, requiring the treatment of Billbergia, which see.

In the following account, the genus is held to comprise the species referred by Mez to Aregelia, having simple flower-clusters, whereas Nidularium proper has compound clusters.

A. *Flower-cluster simple* (*Aregelia*).

B. *Length of flower 1¼ in. or less.*

trìste, Regel (*N. marmoràtum*, Hort., not Morr. *Karàtas trìstis*, Baker. *Aregèlia trìstis*, Mez). Lvs. 6–12, from 6–12 in. long and half as broad in the middle, green dappled with brown, somewhat scurfy beneath: flower purple: bract-lvs. narrow-linear: fr. oblong, white.

BB. *Length of flower 1½ in. or more.*

Morreniànum, Makoy (*Karàtas Morreniàna*, Ant. *Aregèlia Morreniàna*, Mez). Lvs. many in a dense rosette, with few very minute spines, not striped, densely scurfy beneath: fls. many, dark purple: bract-lvs. linear-lanceolate.

N. Carolinæ, Lem. (*N. Mèyendorfii*, Regel. *Karàtas Carolinæ*, Ant. *Guzmània picta*, Hort. *Billbérgia Carolinæ*, Beer. *B. òlens*, Hook.). Lvs. several to many, strap-shaped, rather thick, finely spiny-toothed, 12 in. long, bright green on both surfaces, the bract-lvs. bright red: fls. blue-purple, in a short head nestling in the bright leaf-cup. B.M. 5502. I.H. 7:245.

princeps, Morr. (*N. spectàbile*, Hort. *Karàtas princeps*, Baker. *K. Mèyendorfii*, Ant. *Aregèlia princeps*, Mez). Lvs. 15–20, about 10–12 in. long, broadest at the middle, firm, spiny-toothed, lightly glaucous: fls. numerous, violet-purple, surrounded by about 8–10 oval, bright red bract-lvs.

Binòti, Morr. (*N. Makoyànum*, Regel. *Karàtas Binòti*, Morr. *Aregèlia Binòti*, Mez). Lvs. 15–20, strong-spiny, scurfy and transversely banded on the back, the inner ones similar in color: fls. many, white. Not to be confounded with *Bromelia Binoti*.

AA. *Flower-cluster compound.*

B. *Petals joined below.*

C. *Flowers white.*

Innocèntii, Lem. (*Karàtas Innocèntii*, Ant.). Stemless and stoloniferous: lvs. about 20, in a dense rosette, strap-shaped, about 1 ft. long, broadest near the middle, with many small, spiny teeth, green but more or less tinted brown or red, the oval bract-lvs. bright red: fls. in a dense bead, white. I.H. 9:329.—Named for the Marquis de St. Innocent, amateur, of Autun, France. There is a form with yellow-striped lvs. I.H. 41:5. This species is one of the best Nidulariums.

striàtum, Baker (*N. Makoyànum*, Morr., not Hort. *Karàtas neglècta*, Baker). Lvs. 8–12 in. long, strap-shaped, fine-toothed, prominently striped with central bands of white and shading to cream-color towards the margin, the body color deep green and not brown-tinted. G.C. III. 8:183 (desc.).—A good species.

cc. *Flowers blue or violet.*

Scheremetiéwii, Regel (*Karàtas Scheremetiéwii,* Ant.). Lvs. 10–15, in a short rosette, lanceolate, 10–18 in. long, with many small but conspicuous spiny teeth, rather firm, bright green above and pale green beneath, the bract-lvs. bright red and showy, the points recurving: fls. blue, in a small head.

fúlgens, Lem. (*N. pictum,* Hort.). Lvs. 15–20, in a dense rosette, strap-shaped, with large, strong teeth, mottled with green of different shades, paler and scurfy beneath, the bract-lvs. oval and scarlet: fls. blue.

BB. *Petals separate.*

Lindeni, Regel (*Echmèa ebúrnea,* Baker. *Guzmània frágrans,* Hort. *Canistrum Lindeni,* Mez). Lvs. about 20, in a dense rosette, tomentose, green-spotted, the bract-lvs. cream-white: fls. white or greenish.

Amazónicum, Lind. & André (*Karàtas Amazónica,* Baker. *Canistrum Amazónicum,* Mez. *Echmèa Amazónica,* Hort.). Lvs. 15–20, 10–20 in. long, and rather wide at the middle, greenish brown above and light brown beneath, not spotted or scurfy, the bract-lvs. greenish brown: fls. white, with a green tube, in a dense head.

N. Chantrièri, André, is a hybrid of N. Innocentii and N. fulgens, with very brilliant red bract-leaves, obtained by Chantrier Frères, France. R.H. 1895:452. L. H. B.

NIEREMBÉRGIA (for John E. Nieremberg [1590–1563], a Spanish Jesuit and first professor of natural history at Madrid). *Solanàceæ.* Cup-Flower. About 24 species of hardy perennial herbs from tropical and subtropical America, allied to Petunia and characterized by the long and very slender tube of the corolla. The species in cultivation are valued chiefly for the open border or for pot-plants, and are mostly of prostrate habit, with showy fls. borne freely through the summer and autumn. Stem decumbent or creeping, rarely suberect, diffusely branched, the branches usually slender and nearly glabrous: lvs. alternate, scattered, entire: fls. borne singly on the tips of young shoots, mostly white with a purple center; calyx 5-parted, tubular or bell-shaped; sepals spreading; tube of corolla long, slender, attenuated below, abruptly expanded above into a broad bell-shaped, saucer-shaped or funnel-shaped limb, which has 5 broad, obtuse lobes.

Several species of Nierembergia have distinct value for certain purposes. *N. gracilis* makes an excellent pot or basket plant, and is also popular for the border. *N. frutescens* does finely in the open, but is more desirable as a pot-plant. *N. rivularis* is perhaps the most desirable species of the group, and is adapted to a wide range of conditions. It thrives best in a moist soil with a half-shaded exposure, but often makes fine patches on a dry bank, or even in the rockery. Both *N. gracilis* and *N. frutescens* love a loose, rather moist soil, but are not impatient of dryness. These three species endure winters without protection in the latitude of N. Y.

Nierembergias are propagated chiefly by cuttings taken in the fall, or by seeds. *N. rivularis* is most readily increased by dividing the creeping stem where it has rooted at the nodes.

A. *Stem prostrate or creeping; branches ascending.*

B. *Fls. creamy white, sometimes slightly tinted with rose or blue.*

rivulàris, Miers. White-Cup. Whole plant glabrous: stem slender, creeping, rooting freely at the nodes, forming a dense mat, the branches seldom rising over 6 in. high: lvs. oblong to oblong-spatulate, obtuse membraneous, variable in size, with a long, slender petiole: fls. sessile or short-pedunculed; calyx cylindrical, the lobes oblong-lanceolate, slightly spreading: corolla-limb broadly bell-shaped, 1–2 in. broad; throat golden yellow. La Platte river, S. A. B.M. 5608. J.H. III. 31:311. Gn. 23, p. 188; 25, p. 145.—A very adaptable and desirable species for a stream bank, dry border or alpine garden. The fls. are large and beautiful. It is difficult to eradicate after once established, as small pieces of the stem will take root and grow.

BB. *Fls. white, with purple center.*

grácilis, Hook. Fig. 1490. Branches very slender, ascending 6–8 in., slightly downy: lvs. scarcely ½in. long, linear or slightly spatulate, those on the younger branches somewhat hairy: limb of corolla spreading, convex, white tinged and veined with purple towards the center, throat yellow. Argentine Republic, S. A. B.M. 3108.—A charming little plant for the hanging basket. A garden var., **Crozyàna,** has fls. tinted with lilac and appears to be more floriferous than the type. F.S. 14:1410.

BBB. *Fls. pale lilac.*

Vèitchii, Berkeley. Stem 8–12 in. long, with slender, glabrous or slightly pubescent branches: lvs. ½–1 in. long, short-petioled or sessile, the upper linear, the lower broadly spatulate: calyx-lobes linear-oblong, recurved: corolla-tube ½–¾ in. long, white, the limb broadly bell-shaped. Trop. America. B.M. 5599. F. 1872, p. 141.

AA. *Stem nearly erect.*

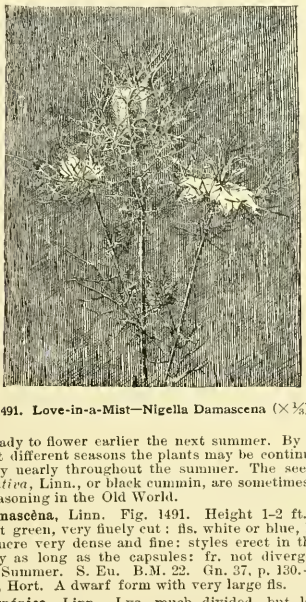
frutéscens, Dur. Tall Cup-Flower. Stem 1–3 ft. high, much branched, shrubby: lvs. scattered, linear: fls. about 1 in. broad, the limb saucer-shaped, white tinted with lilac or blue; throat yellow; handsome. Chile.—The fls. resemble *N. gracilis* in color, but are much larger. Valuable in the greenhouse or for the border. As a pot-plant it makes a fine bush and bears fls. almost continuously. It can be used as a bedding

1490. Nierembergia gracilis (× ½).

plant with excellent results if started under glass and transplanted. A garden form, var. **grandiflòra** (*N. grandiflòra,* Hort.), has somewhat larger fls. than the type. S. W. Fletcher.

NIGÉLLA (diminutive of *niger,* black; referring to the color of the seeds). *Ranunculàceæ.* Love-in-a-Mist. Devil-in-a-Bush. Fennel Flower. Hardy annuals with erect stems and finely divided alternate lvs.: fls. showy, white, blue or yellow; sepals 5, regular, petal-like, deciduous; petals 5, with hollow claws, notched or 2-lobed; carpels 3–10, fusing at the base into one cavity, cells opening at the top when mature; seeds many, black and hard. There are about 12 species, including Garidella; mostly natives of the Medi-

terranean region. The following 2 are only species now used in America. They require little care. The seed should be sown in the open border in good soil any time after the middle of March, and the seedlings thinned, if necessary, to a distance of about 8 in They seldom succeed well if transplanted. If the seeds be sown in early autumn the plants may withstand the winter and



1491. Love-in-a-Mist—Nigella Damascena (×⅓)

be ready to flower earlier the next summer. By planting at different seasons the plants may be continued in beauty nearly throughout the summer. The seeds of *N. sativa*, Linn., or black cummin, are sometimes used as seasoning in the Old World.

Damascèna, Linn. Fig. 1491. Height 1–2 ft.: lvs. bright green, very finely cut; fls. white or blue, large: involucre very dense and fine; styles erect in the fr., nearly as long as the capsules: fr. not divergent at top. Summer. S. Eu. B.M. 22. Gn. 37, p. 130.—Var. **nàna,** Hort. A dwarf form with very large fls.

Hispánica, Linn. Lvs. much divided, but less so than in the preceding: fls. deeper blue than the last, with deep red stamens; involucre absent; styles rather spreading: fr. divergent at top. July. Spain and N. Africa. B.M. 1265. Gn. 37:739.—Var. **Fontanesiàna,** Hort. (*N. Fontanesiàna*, Hort.). Much like the type, but said to flower two weeks earlier. K. C. Davis.

NIGGER TOE. Nuts of *Bertholletia*.

NIGHT-BLOOMING CEREUS. See *Cereus*.

NIGHTSHADE. *Solanum nigrum*. **Deadly N.,** *Atropa Belladonna*. **Enchanter's N.,** *Circæa*. **Three-leaved N.,** *Trillium*.

NINE-BARK. *Physocarpus opulifolia*.

NIPHÆ̀A (Greek, *niphos*, snow; alluding to the white color of the fls., which is rare in this family). *Gesneràceæ*. *N. oblonga* is a plant something like a Gloxinia, but instead of a large spotted throat the flowers have so small a tube as to appear almost 5-petaled. Niphæas are tropical American stemless or dwarf herbs, with heart-shaped, coarsely serrate, hairy lvs. and clusters of about a dozen fls. an inch or so across, borne singly on reddish stalks about 2 in. high. For general cult. they are inferior to Gloxinia and Achimenes, but they are desirable for botanical collections as being one of the most distinct types of the gesneraceous family. They have a creeping root, and no tubers: lvs. soft, wrinkled, petiolate, opposite: corolla nearly wheel-shaped; disk absent; filaments shorter than the anthers, straight; anthers erect, free, the cells facing inward, parallel, confluent at the apex: glands none.

"Like many other plants from Guatemala," says Lindley in B.R. 28:5, speaking of *N. oblonga*, "it seems to require a temperature between that of a greenhouse and of a stove. In its general habits it resembles *Achimenes rosea*. It flowers in the autumn and winter, after which the stems die off, and the plant remains in a dormant state until the following season. When in this state it ought of course to be kept perfectly dry, on a light, warm shelf, and then when the season of rest is past, which will be indicated by the young stems making their appearance, it may be repotted and liberally supplied with water. It forms a great number of curious imbricated scaly buds, both on the surface and under ground, by which it may easily be multiplied in the same manner as Achimenes; it also strikes readily by cuttings. Any rich light soil will do for its cultivation."

oblónga, Lindl. Lvs. heart shaped or perhaps somewhat oblong, more or less whorled: fls. drooping: corolla about 1½ in. across; lobes roundish, concave at first, then revolute. Guatemala. B.R. 28:5.

NIPHÓBOLUS Lingua, var. **corymbífera,** is a tough-leaved, crested fern, recommended by G. W. Oliver for window boxes. Oliver writes that this plant can be quickly increased by division of the stems, which grow near the surface of the soil. Niphobolus appears in a few trade catalogues. By English writers it is generally referred to Polypodium, but L. M. Underwood refers it to the genus Cyclophorus. The typical form of *Niphobolus Lingua* has the sori set in close rows of 4–6 each between the main veins. Rhizomes wide creeping, covered with rusty scales: stalks 3–6 in. long, firm, erect: lvs. entire, oblong-acuminate, 4–8 in. long, 1–4 in. wide, matted beneath with close, cottony, somewhat rusty down. It is a native of northern India and Japan. Its var. *corymbífera* has the lvs. much divided at the apex, forming a flattish, corymb-like cluster. N. N. Bruckner writes that var. **variegàta** is also cult. "It has light yellow lines about an eighth of an inch wide and three-fourths of an inch apart, running across the fronds at right angles to the midrib."

NITROGEN. The rôle of Nitrogen in horticulture is discussed under *Fertility*, *Fertilizers*, *Legumes* and *Manures*.

NOLÀNA (from *nola*, a little bell; referring to the shape of the corolla). *Convolvulàceæ*. About 18 species of prostrate annual herbs with showy blue fls., opening only in sunshine, all native to Chile and Peru. They are valued chiefly for covering poor or rocky soils. Stem often slightly angulate, usually spotted and streaked with purple above, much branched, the ends of the branches ascending several inches: lvs. solitary or in pairs, entire, usually fleshy, the lower long-petioled; the upper short-petioled, sessile or attenuated into a winged petiole: fls. borne singly in the axils of the lvs., mostly short-peduncled, commonly blue or purple, rarely white or rose; calyx 5-parted; corolla funnel-shaped or bell-shaped, entire, 5-angled or 5–10-lobed: ovaries 5 to many, 1–5-seeded, arranged in 1–2 series or clustered irregularly around the base of the style.

The characters by which several species of Nolana have been separated are not well defined. It is probable that *N. atriplicifolia*, *N. prostrata* and *N. paradoxa* should be considered as one species. The chief characters which have been used to distinguish them are the number of ovaries in each fl. and the number of seeds in each ovary; but these characters vary in different plants of these and other species of Nolana. *N. atriplicifolia* is commonly sold under the names of the other two. Consult Benth. and Hook., Genera Plantarum 2:879. Latest monograph D.C. Prod. 13:9 (1852).

Nolanas grow readily from seeds sown in the open in May. For early blooming and for seed production they should be started under glass in March and transplanted in May. *N. atriplicifolia* is used with fine effect when planted in large patches in the border or on rocky hillsides. All of the species do well in pots.

They prefer a light soil and sunny situation. *N. atriplicifolia* is well suited for use in vases and baskets.

A. *Stem smooth or sparsely hairy.*

B. *Fls. large (1–2 in.), dark blue, not striped.*

paradóxa, Lindl. (*N. atriplicifólia,* Hort. *N. grandiflòra,* Lehm.). Fig. 1492. Root-lvs. very long-petioled, ovate; stem-lvs. ovate, mostly sessile or with winged petiole, fleshy; sepals ovate-lanceolate; limb of corolla blue; throat white, inside of tube light yellow; ovaries commonly many, 1-seeded. Peru and Chile. B.R. 10:865, not B.M. 2604, which is *N. tenella.*—This is the most common species in cult. Var. **álba,** Hort., has white fls. Var. **violàcea** (*N. paradóxa,* var. *violàcea*) has violet fls. F.S. 13:1294.

1492. Nolana paradoxa. (×1/4)

BB. *Fls. small (¾ in.), light blue, striped with dark purple.*

prostràta, Linn., not Hook. Throat of corolla marked with violet-purple veins; sepals triangular; ovaries commonly few, 2–4-seeded. Perhaps this should be united with the preceding. Chile and Peru. B.M. 731.

AA. *Stem densely hairy.*

B. *Stem-lvs. lanceolate, thick; plant hoary-pubescent.*

lanceolàta, Miers. Stem-lvs. mostly in pairs, 2–6 in. long, the base obliquely clasping or slightly decurrent on the outer side; fls. 1–2 in. broad, with a spreading, 5-lobed limb, each lobe deeply notched; limb of corolla blue, throat yellowish white. Chile. B.M. 5327.

BB. *Stem-lvs. ovate, membranaceous; plant viscid-hairy.*

tenélla, Lindl. Stem very slender; upper lvs. obtuse, with rounded base and winged petiole; peduncle long-hairy; fls. violet-blue, with a white throat; limb 5-lobed, each lobe tipped with a broad point. Chile and Peru. B. M. 2604 (erroneously as *N. paradoxa,* but poorly drawn, as no hairiness is indicated).—Not advertised in America.

S. W. Fletcher.

NOLÍNA (after P. C. Nolin, joint author of an essay on agriculture, Paris, 1755). *Liliàceæ.* Syn., *Beaucarnea.* Nolinas belong to the remarkable group of desert succulents in the lily family known as the Dracæna tribe, of which the Yucca is the best known example in our gardens. *Nolina recurvata,* which is perhaps the most desirable species, has a striking appearance. It has a fleshy trunk 5–6 ft. high, surmounted by a crown of 100 or more leaves, which are long, linear and gracefully recurved. The base of the trunk is swelled into a sort of tuber a foot or more thick, which sits on the ground like a huge onion. It has numerous very small, greenish white, 6-lobed fls., borne in panicles on flower-stalks several feet high. Nolinas are essentially Mexican plants. They are cult. in S. Calif., requiring similar treatment to Agave, Dasylirion and Yucca, but Ernest Braunton writes that they are not popular. In the East a few kinds are offered. They are desirable plants for fanciers who can house a collection of succulents.

Nolinas are nearest to Dasylirion, but their lvs. are unarmed, while those of the latter usually have hooked spines. Fls. polygamo-dicœcious, the loose racemes forming a simple or compound panicle. Their stamens are included, while those of Dasylirion are exserted. For differences in fruit characters, see *Dasylirion.* The species of Nolina are imperfectly understood. In addition to those given below, *N. Beldingi* is offered. This was lately discovered in lower Calif. by T. S. Brandegee on mountains above Cape St. Lucas. It is arborescent and similar in habit to *N. longifolia,* but with glaucous lvs. (see note below). *Beaucarnea glauca* of the trade doubtless belongs in Nolina. Franceschi says it has a crown of stiff glaucous lvs. on a slender trunk with a bottle-shaped base.

A. *Lvs. 8–15 lines wide.*

B. *Habit of foliage recurved.*

C. *Trunk scarcely bulged at the base.*

longifòlia, Hemsl. (*Dasylirion longifòlium,* Zucc. *Beaucárnea longifòlia,* Baker). Trunk in cult. 4–6 ft. high, 6 in. thick below the crown of lvs.: lvs. 100–200, green, 4–6 ft. long, 9–15 lines wide, perceptibly narrowed from middle to apex. A glaucous form has been cult. G.C. II. 7:493, 567; III. 16:67. R.H. 1876, p. 454.

CC. *Trunk with a bulge at the base a foot or more thick.*

recurvàta, Hemsl. (*Beaucárnea recurvàta,* Lem.). Trunk in cult. 5–6 ft. high, 2–3 in. thick below the crown of lvs.: lvs. green, equally wide all the way, 8–9 lines wide at base. G.F. 9:95. G. C. 1870:1445. F.S. 18, p. 26. I.H. 8, Misc. p. 59.—Var. **intermédia,** Hort., has lvs. which are less recurved and shorter. Var. **rùbra,** Hort., has the lvs. tinged red near the base. No varieties, however, are advertised.

BB. *Habit of foliage strict.*

C. *Width of lvs. 10–12 lines.*

Bigelovii, Wats. Trunk unknown: lvs. thick, flat, 3–4 ft. long, 10–12 lines wide above the base, with a red, horny entire margin.

CC. *Width of lvs. 5–6 lines.*

recurvàta, var. **stricta,** Lem. (*Pincenictítia glaùca,* Hort.). Lvs. shorter and narrower than typical *N. recurvata,* 2–3 ft. long, glaucous.

AA. *Lvs. 2 lines wide.*

Hartwegiàna, Hemsl. (*Dasylirion junceum,* Zucc.). Trunk unknown: lvs. 2 ft. long, with only 7–9 veins instead of about 50.

W. M.

N. Béldingi, Brandg. Aborescent, branching freely: trunk columnar, 1–1½ ft. in diam., 8–15 ft. high: branches short bearing numerous old and new leaves towards the ends: leaves glaucous, a yard or more long, ¾ in. wide, flat, thin, tapering to the point, serrulate on margins, about 50-nerved, weak and recurved: panicle compound, 6 ft. long or more: fruit emarginate: seeds round-ovate, not bursting the cells. Mountains of the cape region of Lower California. Apparently nearest N. Bigelovii, from which it differs in the thinner, more flaccid leaves, and the very much greater size.

T. S. Brandegee.

NONESUCH, or Black Medick, is *Medicago lupulina.* Nonesuch rarely means *Lychnis Chalcedonica.*

NOPÀLEA (from the Mexican name of the Cochineal Cactus). *Cactàceæ.* A genus of 4 or 5 species, often placed with the Opuntias, but differing from the latter in having leaves longer than the perianth, as well as in many minor details. Natives of the West Indies and Mexico. **N. coccinellífera,** Salm., an arborescent, flat-stemmed plant, with a somewhat cylindrical trunk 6–10 in. in diam., is widely grown in semi-tropical countries, but is rarely found in the U. S., and then only in the largest collections of Cacti. It is chiefly interesting in being one of the important food plants of the cochineal insect. B.M. 2741, 2742 (as *Cactus cochinellifer*).

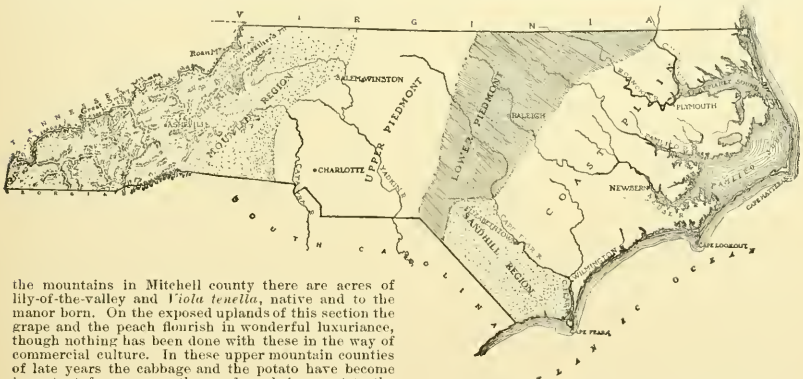
J. W. Toumey.

NORFOLK ISLAND PINE. *Araucaria excelsa.*

NORTH CAROLINA, HORTICULTURE IN. Fig. 1493. Occupying the sunny slope eastward from the highest mountains east of the Mississippi, North Carolina has a greater variety in soil and climate than most other states; hence the horticultural capabilities are varied accordingly. In the region of high plateaus, ranges and valleys lying between the Blue Ridge and the Great Smokies, which mark the line of Tennessee,

is a region dear to botanical collectors for its wonderful flora and of great interest to the horticulturist on account of its capacity for the production of fruit, especially of apples. Here the apple flourishes and produces the most wonderful and uniform crops under conditions of absolute neglect. What could be done here in the production of apples, with careful and intelligent culture and proper handling of the product, has been abundantly shown in the experience of the few who have attempted the culture. In this same region the French wine and table grapes have been flourishing for years, grafted on the native stocks. A complete failure of the apple crop has never been known in the mountains of North Carolina. On the eastern slope of the Blue Ridge are found the thermal belts. These belts are on the mountain slopes and are singularly free from the effects of early frosts in the autumn and late frosts in the spring; in fact, hoar frosts are almost unknown. The cold air settling down in the valleys pushes up the warm air and prevents frost above a certain line, thus insuring the safety of fruit above the frost line. These belts are peculiarly marked in Polk and Wilkes counties. In the high valley lands of Watauga and Ashe counties, lying 3,500 to 4,000 feet above the sea, are meadows where the finest of cranberries grow wild, and on the northern and western slopes of the mountains in Mitchell county there are acres of lily-of-the-valley and *Viola tenella*, native and to the manor born. On the exposed uplands of this section the grape and the peach flourish in wonderful luxuriance, though nothing has been done with these in the way of commercial culture. In these upper mountain counties of late years the cabbage and the potato have become important farm crops, the produce being sent to the southern coast cities in winter. The mountain section is in fact a vast fertile, but undeveloped, region horticulturally. Coming east of the great barrier of the Blue Ridge, we reach the wide rolling uplands of the Piedmont section, stretching its billowy swells eastward to the line of the coast plain, and varying in altitude from 1,500 feet above the sea-level near the mountains to about 350 where it drops off into the level sandy plain bordering the coast for 125 to 150 miles inland. Throughout this region cotton has held undisputed sway for many years except on the northern border, where tobacco has taken its place, and each has shut out much enterprise of a horticultural nature. Still, in some parts of the vast middle section there have been efforts to grow fruits, and in this section are the important nurseries of the state. Near the edge of this upland country, where the clay uplands break up into the rolling forests of long-leaf pine, and swelling sand-hills take the place of the red clay, it has been found that the dry soil and balmy winter climate were particularly favorable to those suffering from lung and throat troubles, and many people from the North, having found health there, remained to make homes on the sand-hills. And making homes, they wanted to grow fruit. Then it was discovered that the sand-hill country could be made to grow the finest of grapes, and now about the town of Southern Pines there are fully 1,000 acres devoted to the culture of grapes for shipment north. These are table grapes, mainly Niagaras and Delawares; they go north early in July, and the business has been a profitable one. Later it was found that the peach flourished on the sand-hills even better than the grape, and that there is seldom a total failure of the fruit. In the same neighborhood there are now at least 1,000 acres in peaches,—over 400 acres in one orchard. Shipments begin here about the first week in June, and in some seasons the Sneed peach is ready the last of May. A large area is being devoted to blackberries and strawberries also, as blackberries can be sent from here before strawberries are ripe in New York. Here, too, it is being found that the bulbs imported so largely for the use of florists for winter forcing, such as lilies, Roman hyacinths and narcissus, can be grown to great perfection. Experiments are being made with the Bermuda lily, and it is hoped that the bulbs can be produced here early enough for the early forcing, and that we may be able to grow healthy bulbs to take the place of the diseased Bermuda stock.

Horticulturally, the most interesting part of the state is the great level coast plain. Here the mellow soil, mild climate and abundant rainfall combine to make conditions favorable to great production, especially in the culture of small fruits. Along the line of the Atlantic Coast Line R. R. strawberries are grown by the thousand acres, and the culture has brought



1493. North Carolina, showing horticultural regions.

wealth to the growers. This, too, is the section where the greater part of the tuberose bulbs used by florists in this country and in England are produced on contract for the dealers in New York, Philadelphia and Chicago. Some attention is being paid, too, to the culture of caladiums, gladiolus and other bulbous and tuberous crops. The winter culture of lettuce in frames covered with cloth and glass has of late become a very important item in the gardener's list of crops in this section. It takes but little protection here to grow in winter lettuce as fine as that produced in heated houses in the North, and the rapid railroad communication makes the selling a sure matter. An industry that will grow here is the shipping north in winter of cut-flowers of narcissus and Roman hyacinths from frames and the open ground, and of gardenia flowers from the great bushes in the open ground in summer. Near the coast, as at Newbern, the market-garden business absorbs the entire attention of cultivators. From this section there are shipped of vegetables of all kinds in the spring and early summer over $4,000,000 worth annually, and the business is increasing steadily. With the coming of a dense population, the great swamps that now cover hundreds of square miles will be drained and more land of inexhaustible fertility will be added to this fertile region; here will be located the future bulb farms of the United States, and the dealers

of New York and other northern cities will come here to make their contracts instead of going to France, Italy and Holland. Already some Holland growers are talking of coming to spy out the land, and the great development of the future in North Carolina will evidently be, so far as horticulture is concerned, in bulb culture.

W. F. MASSEY.

NORTH DAKOTA (Fig. 1494) lies between lat. 46° and 49° N. and long. 96° 25′ and 104° W. The special advantages of soil and climate for the production of grass and the small grains have given the state great agricultural prominence, but little has been done along horticultural lines. While it possesses undoubted possibilities along certain lines of fruit production, and in the growing of certain vegetables can hardly be excelled, yet these things have always been considered incidental and not to be classed with the leading soil industries. North Dakota settlers, for the most part, did not come from fruit regions, and in no case have they occupied the land with other intention than to raise stock and grain. At the same time, as population increases and homes become established, there is the natural tendency to protect these homes with trees, ornament them with shrubs and flowers, and furnish the tables with vegetables and fruit. Such is the present incentive to activity in horticulture, and its future status will be controlled by the following natural conditions:

Physical and Geologic Features.—Its distinctive regions are referred to as the Red river valley, the Turtle mountain country, the Devil's Lake region, the Mouse river country, the James river valley, the Missouri slope and the western range country, including the Bad Lands. The Red river valley is a level plain from 20 to 30 miles wide on the North Dakota side and extending across the state north and south, thus embracing an uninterrupted area of some 6,000 sq. miles, all level and of great fertility. This is preëminently the wheat belt of the state, and the character of the soil is such in both physical and chemical properties as to insure an excellent growth of such plants as are hardy and will mature within the season. The soil is a lacustrine deposit containing about 33 per cent of very fine sand, 55 per cent clay and silt, and 12 per cent organic matter and soluble salts. It is so rich in nitrogen and phosphoric acid as to be quite indifferent to fertilizers, even when applied to such garden vegetables as demand the most fertile soils. It rarely bakes under reasonable cultivation, is never lumpy and is very retentive of moisture. It is unusually well adapted to the cultivation of practically all vegetables, particularly celery and other plants requiring a deep, fine, easily worked soil.

This general type of soil is not confined to the Red river valley, but is the predominating surface soil for most of the state lying east of meridian 101 and of considerable tracts still further west. The subsoil in the Red river valley lying under three or four feet of very dark loam is uniformly a soft yellowish clay extending to a great depth. Much of the subsoil outside of the valley is largely made up of firmly compacted sand, with a small percentage of clay. Such lands are not so good as those having the clay subsoil, but with the good surface soil which they support they are capable of producing large yields in seasons not too dry. They are naturally not so well adapted to horticultural operations as are the lands having the clay subsoil.

Speaking in general, the soil lying west of the 100th parallel, also that of the Missouri slope, Turtle mountain and Mouse river countries is all well suited to vegetable and fruit culture, though partial failure may result from short seasons. This is especially true upon the level, rich soil of the Red river valley, which tends to prolong the growth of such plants as the grape and apple beyond the season in which they should mature. The more rolling surface of the land along the Missouri river affords opportunity to select favorable sites for fruit plantations, and there is doubtless some advantage in the soil itself. This is apparent in the cultivation of the grape, or such vegetables as the tomato, squash and melon. So far attempts to grow fruit on the lighter and more rolling soils, avoiding the extremes, has met with reasonable success. On the heavier soils and level lands success has been confined to the cultivation of such small fruits as the currant, gooseberry, raspberry and American plum and vegetables maturing not later than the earliest sorts of tomato or second early sweet corn. In connection with the fact that attempts at apple culture have generally been unsuccessful, it should be remembered that plants, as a rule, cannot make long jumps. The line of apple culture is gradually moving northwest, the successful varieties being those, like the Wealthy and Peerless, that have originated in the newer places. A region so far removed from the apple districts as North Dakota is must have the time and opportunity required to develop varieties of its own.

Climate and Rainfall.—Removed from all influence of large bodies of water, North Dakota has a dry climate subject to considerable extremes of temperature. The mean annual rainfall at Fargo for the years 1892 to 1899, inclusive, was 19.87 in., distributed by seasons as follows: Spring, 5.49 in.; summer, 10.02 in.; fall, 3.61 in.; winter, .51 in. Most of the precipitation is in spring and summer, when it is most needed. The average rainfall for June is 4.17 in. The fact that the great majority of agricultural lands in the state are absolutely flat, as near as land may be, and composed of a soil very retentive of moisture, makes what would otherwise be a light rainfall generally sufficient for ordinary needs. Further west than Fargo the rainfall gradually becomes less. For the twenty years between 1870 and 1890 the annual rainfall of the places named below was as follows: Bismarck, 18.90 in.; Fort Buford, 13.29 in.; Fort Totten, 17.78 in.; Pembina, 20.30 in.

The temperature is very uniform throughout the state, with the general difference that the range country in the western part has milder and more open winters, and the higher altitude, as well as latitude, of the northern tier of counties gives them a shorter and cooler summer, more inclined to frosts. It is only in that section that corn has not been considered, so far, as a possible crop.

At Fargo the mean temperature for the different months since 1892 is as follows:

Jan.....	1.6	May.....	54.8	Sept.....	59.1
Feb.....	6.2	June.....	65.9	Oct.....	42.3
March.....	10.7	July.....	68.7	Nov.....	18.3
April.....	40.7	Aug.....	66.2	Dec.....	9.4

The following table of soil temperatures, comparing Fargo with Geneva, N. Y., is instructive and shows why, with the longer hours of daylight, vegetation develops rather more rapidly in North Dakota than in New York:

1896	*1 in.*	*3 in.*	*6 in.*	*9 in.*
June — Fargo.....	65.1	62.2	59.6	58.6
Geneva.....	67.3	66.5	65.5	65
July — Fargo.....	75.9	68.8	64.8	64
Geneva.....	76.6	72.4	69.3	67.8
Aug. — Fargo.....	76.5	68.1	67.3	63.6
Geneva.....	73.2	70.8	69.3	68.3
Sept. — Fargo.....	60.1	56.1	53.9	55.5
Geneva.....	64	63.1	62.1	61.2

The amount of soil moisture given in the following table, covering the years from 1892 to 1896, inclusive, shows that the comparatively high soil temperature is not due to extreme dryness. The samples were taken each week to a depth of 7 in. from a cultivated field in which wheat was grown a greater part of the time:

	Average for five years
May.....	29.66 per cent
June.....	24.61 "
July.....	21.48 "
Aug.....	20.19 "
Sept.....	20.10 "
Oct.....	19.78 "

As the water capacity is about 70 per cent and the land level, there is practically no loss from leaching or drainage. While these tables represent tests in a single locality, yet they would apply with exactness to 6,000 square miles and approximately to some 4,000 more.

Soil Fertility.—Samples of soil taken from different parts of the state from time to time and analyzed by Prof. E. F. Ladd, of the experiment station at Fargo, show that the nitrogen rarely falls below .2 per cent and in most instances reaches from .3 to .5 per cent, with an occasional sample yielding .7 per cent. The potash ranges from .25 to 1 per cent, the average sample giving about .5 per cent. The phosphates range from .15 to .25

per cent on the average, with many samples giving as high as .30 per cent.

General Climatic Conditions.— The winters are cold but dry and agreeable. An occasional winter with too much sunshine kills young trees of the thin-barked varieties through the process of desiccation.

The springs are short, the warm days of summer coming very soon after winter and some time before the frost is out of the ground. In summer the days are long and sunny, with nights invariably cool. This condition gives the most perfect development of hardy vegetables, like the cabbage and celery, but retards the cucurbits and other semi-tropical species. At the same time, the fruit that does mature is of undoubtedly high quality and rich flavor, while the sugar beet and sweet corn give a very high sugar content.

The fall is usually dry and very pleasant, favorable to the maturing of woody plants, but rather liable to frosts. The ground freezes permanently about November 10.

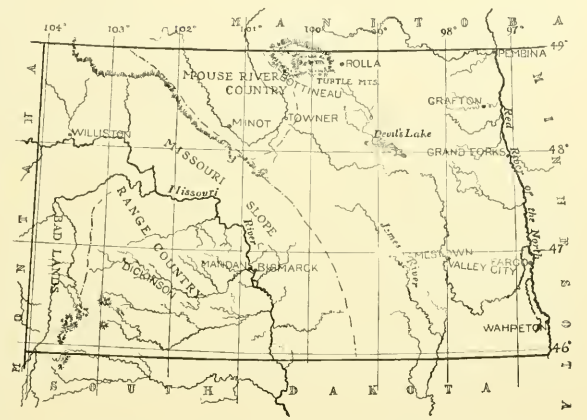
Fruit-growing.—General settlement of what is now North Dakota did not begin till the building of the first railroad in 1873, and any effort to grow fruit has been made since that time. In 1874 Andrew McHench, of Fargo, made the first attempt at fruit-growing upon any extended scale. In that year he bought, at a nursery in Minneapolis, a car-load of young apple and crab trees of such varieties as the Wealthy, Hyslop, Transcendent, etc., and the year following planted 7,500 root-grafts of these and other varieties. Though Mr. McHench obtained some fruit and at different times grew trees that were models of thrift and fruitfulness, yet the venture was not a success.

The varieties that successfully resisted the cold winters succumbed to the blight (*Bacillus amylovorus*) shortly after they came into bearing. Other attempts by different men made along the Red river valley since then have resulted similarly. In other sections of the state, particularly the Missouri slope, experiments in apple-growing have been more successful, this being due especially to less prevalence of blight. It is rather early to make the prophecy, but it seems reasonable that with irrigation the southwestern part of the state will, in time, become the apple region. Even without irrigation there are already indications of success.

The strawberry does not thrive in the strong sunshine and winds of North Dakota, and the blackberry finds the winters too cold, but gooseberries and currants grow and bear well anywhere and the hardy varieties of the raspberry thrive with winter protection. Grapes have never been thoroughly tried, but it is doubtful if their cultivation ever becomes general.

Vegetable Culture.—There are but few vegetables that cannot be produced abundantly and cheaply. This is particularly true of celery, onions, parsnips, etc., that require a deep, mellow soil. The season is long enough for the earlier sorts of corn, but tomatoes do not always ripen before frost. The ease with which the soil is worked and the fact that no fertilizer is required reduces the cost of production to the minimum.

The Flora.— So far as collected, the flora of North Dakota includes about 600 spermaphytes and vascular cryptogams running through 80 families. The grass family is by far the prevailing one, though the composites present the largest number of species. About 85 grasses have already been collected. Forests are found only along streams and in the broken areas south of Devil's Lake and in the Turtle and Pembina mountains. The number of species of trees is very limited. The more prominent of the trees as regards distribution and size are the bur oak and white elm in the eastern part of the state, and cottonwood and green ash in the western. The box elder, linden, aspen and hackberry are about the only other trees commonly found. The red cedar is found to some extent along the Little Missouri. In establishing tree plantations, the white ash, white willow, box elder and cottonwood are the trees usually employed. With reasonable cultivation it is not difficult to obtain a thrifty, rapid growth of these. In proportion to the trees



1494. North Dakota, to show some of the physiographical features.

the number of shrubs is large and, besides several of the commoner kinds of the Middle States, includes such striking species as *Shepherdia argentea* and *Elæagnus argentea*. *Rosa blanda* is found everywhere in great profusion, exhibiting a variety of exquisite colorings. Aside from the grasses the compositæ are most in evidence, and throughout the summer and fall the bright colors of Gaillardia, Rudbeckia, Echinacea, Liatris, sunflowers and asters make a profusion of gaiety. The legumes, too, are very common, the bright Petalostemons and Astragalus adding much to the showiness and richness of the landscape. The high nitrogen content of the soil is probably due in large measure to the prevalence of the Amorphas and vetches. The prairie fires that swept over the state annually for many hundred years have doubtless greatly modified the flora. As a result, the indigenous flora had very few annuals or plants with perennial tops, and these only in broken places, or along streams where the fires did not penetrate. In the western part of the state insufficient moisture would account for lack of forests. The remains of large trees in petrefactions and lignite deposits tell us that in cretaceous times the conifers found a most congenial home, while towards the tertiary period the angiosperms appeared.

Native Fruits.—While the wild fruits occupy an inconsiderable portion of the total area of the state, yet they are important in that they furnish thousands of families with their yearly supply of jellies and other fruit products. A list of the wild fruits in order of their importance would be about as follows: plum, buffalo berry (*Shepherdia argentea*), cherry (*Prunus demissa*), grape (*Vitis vulpina*) and Juneberry (*Amelanchier alnifolia*). The red raspberry and strawberry are also found sparingly. The only plum in the state is *P. Americana*, and this is found wherever other trees or shrubs grow. It is sometimes confined to thickets, as in the Middle States, or it may be scattered for miles along with the thorn and Juneberry. It is strongly variable in almost every character except fruitfulness, all forms being decidedly prolific. The shrub rarely grows more than 8 feet high. The fruit generally is of good quality,

sweet and rich when ripe, but too soft to keep well. In a domestic way wild plum jelly is recognized as a staple article of superior merit, and though the plums are abundant in most seasons, yet they readily bring $2 per bushel in the local markets. The improved strains of this plum, like the DeSoto, Weaver and Aitkin, are being introduced and successfully cultivated. The buffalo berry is found from the James river westward, growing in thickets along streams and coulees. The bright red acid fruit is borne in the greatest profusion, but is rather difficult to gather, as it is sessile and thorns are plenty. It makes a clear jelly of reddish amber color and delicate flavor. The choke cherry of North Dakota is a puzzle botanically, and until further studied may as well pass for *P. demissa*. It is nearer to that, in superficial characters at least, than to *P. Virginiana*. The fruit is used to some extent for wine and marmalade and with other fruit in making jellies. *P. pumila* is widely scattered but not abundant, and the fruit is used but little. In the western part of the state the Juneberry produces abundantly a large fruit of rich flavor, but is more often used fresh from the bushes than in a culinary way. The rapid settling of the state has increased the demand for native fruits to such an extent that their value is being appreciated, and private ownership even in wild fruits is being insisted upon and recognized. This, of course, leads directly to the development and preservation of the better strains.

CLARE BAILEY WALDRON.

NORTHWEST TERRITORY. See *Canada*.

NOTHOFÁGUS (Greek words, meaning *not a true beech*). *Cupuliferæ*. A genus of about 12 species, native of S. America, Australia and New Zealand, closely allied to Fagus, but chiefly distinguished by the fls., both staminate and pistillate ones being borne in 3's or solitary. The lvs. are generally small, often evergreen and either plicate in bud, like those of Fagus, or not. The wood of some species, especially that of *N. Dombeyi* and *N. procera*, in Chile, and of *N. Cunninghami*, in Australia, is much valued. They are not hardy in the North, and but little known in cultivation; they are probably not cult. in this country, though the following 4 species have been introduced into European gardens and have proved fairly hardy in England: *N. Antárctica*, Oerst., *N. obliqua*, Oerst., *N. betuloides*, Oerst., *N. Cunninghami*, Oerst., all trees or sometimes shrubby, with small, ovate or elliptic, crenate-dentate lvs., ½–1 in. long. The 2 first named are deciduous, the other 2 evergreen. They are perhaps oftener enumerated under Fagus, but besides the difference in the fls. they are strikingly different in habit, especially on account of their very small lvs., large only in *N. procera*.

ALFRED REHDER.

NOTHOLÆ̀NA (Latin, *spurious, cloak;* from the rudimentary indusium). *Polypodiàceæ*. Often written *Nothochlæna*, but the above is Robert Brown's original orthography. A genus of mostly warm temperate rock-loving ferns, differing from Cheilanthes mainly in having no marginal indusium. Some of the species are coated with a golden or silvery wax-like powder. The following have been advertised only once by a dealer in native plants. See *Fern*.

A. *Fronds densely matted beneath.*

B. *Lvs. once pinnate.*

sinuàta, Kaulf. Lvs. 1–2 ft. long, 1–2 in. wide, growing on short stalks from thick, scaly rootstocks; pinnæ thick, entire or deeply pinnatifid; lower surface with rusty scales. Southwestern U. S. to Chile.

ferruginea, Hook. Lvs. 6–12 in. long, ½–1 in. wide, growing on wiry black stalks from thick, dark, scaly rootstalks; pinnæ deeply pinnatifid, with blunt lobes; texture thinner; lower surface densely matted with wool. Southwestern U. S. to West Indies and Chile.

BB. *Lvs. 3- to 4-pinnate.*

Néwberryi, D. C. Eaton. COTTON FERN. Lvs. 3–5 in. long, on stalks of the same length; ultimate segments ⅛–⅛ line wide, covered on both sides with slender, entangled hairs, which are more dense on the under surface. Calif.

Párryi, D. C. Eaton. LACE FERN. Lvs. 2–4 in. long, tripinnate, with crowded roundish obovate segments 1 line wide, which are densely covered above with entangled white hairs, beneath with a heavier pale brown wool. Utah to Calif.

AA. *Fronds with white or yellow powder beneath.*

cretácea, Liebm. Rootstock short, with rigid scales: lvs. 1–2 in. each way, pentagonal on brownish stalks 2–7 in. long; ultimate segments oblong or triangular-oblong, crowded. Southern Calif. and Ariz.—Less handsome than the similar but larger and less divided *N. Hookeri* of Texas to Arizona.

cándida, Hook. Rootstock creeping: lvs. 3–6 in. long, ovate or deltoid-ovate, pinnate; lowest pinnæ with inferior pinnules elongated and again pinnatifid; upper surface green. Tex. and New Mex.

AAA. *Fronds naked below.*

ténera, Gillies. Lvs. 3–4 in. long, ovate-pyramidal, 2–3-pinnate: pinnæ distant, with ovate or subcordate, smooth, naked segments. S. Utah and Calif. to Bolivia. —Very rare.

L. M. UNDERWOOD.

NOTHÓSCORDUM (Greek, *false garlic*). *Liliàceæ*. About 10 species of herbs having an onion-like bulb and closely related to Allium. Most of the species are found in tropical S. Amer., 1 in China and 1 in the U. S., ranging from Va. to Ind., Neb. and southward, in open woodlands and prairies. The bulb is without the onion odor and taste: scape 6–12 in. high: lvs. linear, basal, 6–12 in. long: fls. yellow or white, in an umbel: capsule oblong-obovate, somewhat lobed, obtuse: style obscurely jointed: ovary 3-loculed; ovules several in each locule.

striàtum, Kunth. YELLOW FALSE GARLIC. STREAK-LEAVED GARLIC. Bulb globular, 1 in. through, sometimes bearing bulblets at base: scape 1 ft. or less high: lvs. 7–8 in. high, 1–2 lines broad: fls. white, 6–7 in an umbel on slender pedicels, the segments narrowly oblong, 4–6 lines long: ovules 4–7 in each cell. Early spring. Va., west. B.B. 1:415.—Hardy. Procurable from dealers in native plants.

M. B. COULSTON.

NOVA SCOTIA. See *Canada*.

NÚPHAR (from the Arabic). *Nymphæàceæ*. SPATTER-DOCK. YELLOW POND LILY. Six or eight aquatic plants of the north temperate zone, with stout rootstocks creeping in the mud, and large, cordate-ovate or sagittate lvs., some of which are floating and others either floating or standing erect above the water: fls. usually standing above the water, yellow or purplish, single on the scapes, the sepals 5 or 6 or more and constituting the showy part of the flower; petals numerous, small and usually simulating stamens, the latter numerous and short: ovary short and globular-ovoid, with 8–24 stigmas forming rays on its top: fr. a small, emersed capsule. The largest part of the Nuphars are North American. They grow in stagnant pools or on the margins of slow-running mud-bottom streams. Although several species have been offered by dealers, most of them have small value for the cultivator, although the foliage effects of *N. advena* may be striking. For culture, see *Nymphæa* and *Aquatics*. By some the Linnæan Nymphæa is used for this genus, and Castalia is used for the true water lilies. See *Nymphæa*.

A. *Lvs. mostly cordate-ovate: northern.*

B. *Plants strong and large.*

ádvena, Smith. COMMON SPATTER-DOCK. Fig. 1495. Lvs. large (about 1 ft. long), varying from cordate-ovate to cordate-oblong, thick, with a deep and mostly open basal sinus, the lower surface often pubescent; submerged lvs. usually wanting: fls. 2–3 in. across, more or less globular (not wide-opening), yellow or purple tinged, the petals fleshy and truncate, the sepals 6: stigma with 12–24 rays. N. Brunswick to Fla. and west. Mu. 1:17. G.C. II. 20:557.

rubrodiscum, Morong. Lvs. somewhat smaller; submerged lvs. usually present: fls. 1–1½ in. across, yellow, with 5 or 6 sepals, the stigmatic disk bright red and 9–12-rayed, the petals spatulate and fleshy. Penn. to Mich., and north.

polysèpalum, Engelm. Larger than *N. advena,* the lvs. three-fourths as broad as long, erect in shallow water and floating in deep water: fls. 4–5 in. across, yellow, the sepals 8–12, and the petals 12–18 and broad. N. Calif., northward and east to the Rockies.

1495. Nuphar advena (× ⅛).

lùteum, Sibth. & Smith. EUROPEAN YELLOW LILY. Lvs. cordate-ovate, floating or rising little above the water: fls. yellow, somewhat fragrant, smaller than those of *N. advena,* the sepals 5, and the petals very numerous: stigma 10–30-rayed. Europe.

BB. *Plant slender, often delicate.*

mínimum, Smith (*N. pùmilum,* DC.). Slender: lvs. small, oblong, with a deep sinus and spreading lobes: fls. 1 in. or less across, yellow: stigmas 8–12, prominently indented. Eu.—By Bentham considered to be a form of *N. luteum.*

Kalmiànum, R. Br. (*N. lùteum* of American authors, at least in part). Slender, with prominent submerged orbicular, lettuce-like lvs., and the emersed ones floating, and only 3 or 4 in. long: fl. 1 in. or less across, yellow, with 5 sepals, and thin spatulate petals: stigmas 6–7. N. Y., west and south.—A very interesting plant.

AA. *Lvs. long-sagittate or narrow-oblong: southern.*

sagittæfòlium, Pursh. Rather stout: emersed lvs. floating, about 1 ft. long and 2–3 in. wide: submerged lvs. similar in shape, numerous: fls. 1 in. across, yellow, the sepals 5, the petals spatulate: stigmas 11–15. Southern Indiana and Illinois southward.

L. H. B.

NURSERY: in horticulture, an establishment for the rearing of plants. Properly, a nursery exists for the rearing of any kind of plant, but in America the word is restricted to an establishment devoted to the growing of hardy, more particularly woody plants. This is because of the early and great development of orcharding and tree planting and the relative infrequency of glass structures.

In North America the nursery business, as we now know it, is practically an institution of the present century, although there were nurseries more than a century ago (see Vol. II, p. 766). As early as 1768, according to J. H. Hale, the New York Society for Promotion of Arts awarded Thomas Young a premium of £10 for the largest number of apple trees, the number being 27,123. But the large trading nursery developed simultaneously with the great orchard planting industry which began in western New York and extended westward, and, since the civil war, to the southward.

The only available statistics covering the general range of the United States nursery business are those published in Bulletin 109 of the Eleventh Census (figures for 1890), by J. H. Hale. The census enumerated the items of 4,510 nurseries, occupying 172,806 acres and representing a valuation of $11,978,835.80. The total capital invested was about $52,500,000. These establishments employed 45,657 men, 2,279 women, and 14,200 animals. The total number of plants and trees was 3,386,858,778, which figure does not include unenumerated plants on 1,477 acres of nursery grounds. Of this enormous total, fruit trees comprised 518,016,612 plants, and grape vines and small fruits 685,603,396. Apple trees alone, the highest figure given for a single species, numbered 240,570,666. It is safe to assume that each plant in this uncountable number was the subject of thought and solicitude on the part of the propagator; yet it is probable that not one in a hundred has lived to bring satisfactory reward to the buyer. It has been estimated that the apple trees now standing in orchards in the United States are 100,000,000, or less than half the number growing in the nurseries in 1890. The elements of loss are many, but the greater part of the failures occur after the stock has passed to the hands of the final purchaser.

The largest nursery center of North America, considering the number of persons engaged and the variety of stock grown, is western New York. The headquarters of this industry is Rochester. See *New York.* Nearly one-ninth of all the nurseries enumerated in 1890 were in New York state, and these establishments employed a capital of over $12,000,000. Very extensive nursery enterprises are now established in many other parts of the country, and it is probable that the center of the nursery business will move westward.

In America, nursery stock is grown on a large scale. This is particularly true of fruit trees. These trees are to be set in wide and open orchards, and the nursery practices are therefore very unlike those which obtain in Europe. In the latter country, for example, fruit trees are trained in the nursery row to assume definite shapes. Some are trained for standards,—to grow to one straight, bare trunk. Others are trained for bush specimens, some for growing on walls and espaliers, some with round heads, some with conical heads, and the like. It is the pride of the American nurseryman, however, that his rows shall be perfectly even and uniform. Any break in this uniformity is considered to be a blemish. If every tree could be a duplicate of every other, his ideal would be attained. Ordinarily, fruit trees are trained to single stems, the top starting at two or three feet from the ground. All fruit trees are budded or grafted. In the older parts of the country, budding is much preferred. In early days, root-grafting the apple was a common practice in the eastern states; but it has gradually given way to budding and thereby a top is supplied with one whole strong root. In the western states, however, root-grafting is still popular, partly because more than one tree may be made from an individual root, and partly because it allows the operator to use a long cion and to put the foster root far below the surface, thereby allowing the cion to send out its own roots and causing the tree to become own-rooted and to have a known hardiness.

There are many diseases and difficulties in the growing of all kinds of nursery stock. The most widespread and fundamental difficulty, however, is the inability to grow many crops of trees on the same land with good results. In fact, in the case of fruit trees it is usually considered that land which has been "treed" is therefore unfit for the growing of other fruit stock until it shall have rested in clover or other crops for a period of five years or more. Ornamental stock is often grown continuously on the same land with good results, even when the same species is grown. This is largely due to the fact that ornamental stock is sold by its size and not by its age, and therefore rapidity of growth is not so important as it is in the case of fruit trees. It has been supposed that this necessity of rotation is due to the exhaustion of certain plant-food elements from the soil. It has been found by careful experiments, however, that

such is not the case. The chief difficulty seems to be a physical one. Lands which are devoted to nursery stock for one crop, which is from two to five years, becomes void of humus, and the digging of the stock when the land is wet or unfit to be worked tends to impair the physical character of the soil. Experiments have shown that commercial fertilizers will not always reclaim lands which have been treed, whereas barn manures and green crops may go very far towards revitalizing them. As a

1496. View in an American apple-tree nursery.

result of inability to grow vigorous stock on treed land, a large part of the nursery stock of the country, particularly fruit trees, is grown on rented land. On the nurseryman's central grounds a variety of stock may be grown, chiefly ornamentals, but the larger part of the commercial fruit stock is farmed out to persons who are willing to rent their land for this purpose and who will give the requisite attention to the growing trees.

The nursery interests of this country are represented in a strong organization known as the American Association of Nurserymen, which holds a movable annual meeting in June and publishes a report. There are also societies representing geographical regions. At the present time, there is one periodical devoted to the nursery business, "The National Nurseryman," published monthly at Rochester, N. Y. The American current book writings devoted specifically to the business are Fuller's "Propagation of Plants" and Bailey's "Nursery-Book."

L. H. B.

NUT in common language usage is any hard-shelled fruit which will keep for a more or less indefinite time without special efforts at preservation. In a botanical sense, a Nut is a hard and dry indehiscent 1-seeded fruit in which one or more ovules have been suppressed by abortion. In this sense, walnuts, hickory-nuts, acorns and cocoanuts are Nuts, but almonds, peanuts and Brazil-nuts are not.

L. H. B.

NUT, AUSTRALIAN. *Macadamia ternifolia.*

NUT, CHILEAN. *Gevuina Avellana.*

NUT-CULTURE. From the earliest times nuts have been used as an article of food in North America. The prehistoric tribes left evidences of their use in the specimens which were buried with their remains. When the white settlers came they found several kinds of nuts growing wild and bearing abundantly, and thought to introduce the cultivated nuts of Europe along with fruits and farm crops that seemed to flourish in the virgin soil. But little success seemed to attend their early efforts, largely because of the unsuitability of the varieties tested. The sweet almond and the hazels were found to be of this character, and the few experiments with the European walnut and chestnut, where they did succeed, were not followed up by extensive plantings for many years. Nor were any of the native nuts brought under cultivation until very recently. Now there are many orchards and groves of both foreign and native nuts, some of which are already yielding profitable crops.

The Almond (*Prunus Amygdalus*).—Among the first nuts to be tested were the cultivated almonds. All the experiments up to the present day lead to the conclusion that the choice varieties are not suited to any section east of the Rocky mountains, except, perhaps, in southwestern Texas and New Mexico. The close relationship to the peach would cause us to expect that it would succeed wherever that fruit does; but the trees of the choice varieties are too tender to endure any but very mild climates, and the fruit-buds are still more tender. The chief failing, however, is the habit of very early blooming, which causes the crop to be cut off by spring frosts, except in peculiarly favorable localities. There are differences in the ability of the varieties to endure cold and in time of blooming, even where they are counted a success. Not until seedlings were grown and tested, from which selections were made of suitable kinds, did the growing of this nut prove profitable.

Regions and Methods of Culture.—At the present time the culture of the almond is confined chiefly to California, and to some extent in Oregon, Utah, Idaho, Arizona and New Mexico. Fair crops of almonds of the highest quality in all respects are grown there. There are single orchards in California of hundreds of acres in extent. The crop of 1899, in that state, was estimated to be about 50 car-loads of 20,000 pounds each. It is thought that the production of new seedlings will still further overcome the weak points already mentioned, and materially extend the culture of really choice varieties. The methods of planting and cultivation of the soil are about the same as for the peach. Twenty feet is a good distance apart for the trees in rich soil. Unlike the proper treatment for peach trees, the almond tree should have but little pruning, owing to a different habit of the fruiting branches. See also *Almond.*

The Walnuts.—*American Walnuts.*—The kernels of all species of the walnut family are liked because of their rich and delicious flavor; but some of them are so small and difficult to get out of the shell that they are of little or no commercial value. Our native black walnut, *Juglans nigra*, and butternut, *J. cinerea*, are of this character. At present there are very few trees of either species that are grown for their nuts; but there are some prospects of improvement in this direction.

Asiatic Species.—Within the last 25 years there have been introduced from Japan two new species of walnuts, *J. Seiboldiana* and *J. cordiformis*, and from Manchuria one, *J. Mandshurica.* These make beautiful and stately trees, but the nuts of all but *J. cordiformis* have too thick shells to be of much value. See *Juglans.*

Persian Species.—The Persian walnut, *J. regia*, which has long been called English walnut and by several other titles, has been cultivated for many centuries for its thin-shelled and richly-flavored nuts. It is a native of Persia and the regions about the Caspian Sea. The Greeks and Romans took it to southern Europe before the Christian era. It was brought to America in the early settlement of the country, but did not succeed everywhere, and the few trees that survive in the eastern states have been mostly neglected. Some of them have borne nuts abundantly and others have not. Unproductiveness has generally been due to the isolation of the trees and the inopportune times of the blooming of the flowers of the two sexes. These isolated trees are scattered over the eastern states from New York to Georgia, and rarely beyond the Appalachian mountain chain, because of the more uncongenial climate there. Whether or not there will eventually be orchards of this nut in the eastern United States is doubtful.

Regions of Successful Culture.—On the Pacific coast the Persian walnut is a great success. True enough, there are some failures, but they are mostly due to lack of proper pollination, a matter which can and will soon be generally understood and overcome. There are extensive orchards already in bearing, and with the advantages which are now being afforded by the introduction of the best varieties from Europe and the origination of improved seedlings, the walnut industry is sure to rapidly advance in that region. The soil of the richer valleys of the Pacific slope is just what is needed, and where there is an abundant supply of water a few feet under the surface there is no need of irrigation. But in poor, dry soil it is folly to expect success. The crop of California, alone, in 1899, was about 550 car-loads of 20,000 pounds each. It is confidently ex-

pected that California will, within a few years, produce all that our home markets require.

Propagation and Tillage.—The larger number of bearing trees are seedlings, but those grafted or budded with choice varieties are far preferable, and such trees will form the walnut orchards of the future. The distance for the trees to stand apart in the orchard is from 25 to 50 feet, according to the vigor of the variety and the richness of the soil. Clean tillage is best for the trees until they reach bearing age, when the ground may be seeded to some grass that does not make a compact sod. If hoed crops are grown between the trees until that time it will do no harm and economize the space. Almost no pruning is needed for this tree, except to keep the branches from getting so low as to interfere with tillage. See *Walnut*.

The Chestnuts.—*American Species.*—Like the walnuts, our native chestnuts are not so desirable for market purposes as those from foreign countries. The wild American chestnut, *Castanea Americana*, is richer in quality than any foreign kind, but the size is less than half that of the introduced nuts. Throughout the larger part of the eastern United States, and extending into lower Canada, there are untold millions of native chestnut trees, yielding a wealth of nuts that find ready sale in the markets, so far as they are gathered; but the prices are only about half those of the large cultivated and imported product. At the present time there are but few attempts made to cultivate this species. Some of the choice varieties with the largest nuts are being collected for experiment, and there is reasonable prospect that by hybridization and selection of seedlings we may yet have varieties combining the vigor and hardihood of the wild trees with the characteristic natural sweetness and large size of the foreign nuts.

The chinquapin, *C. pumila*, is the smallest of the chestnut family, in size of both nut and tree. Rarely is it anything more than a mere bush. It has rarely been cultivated, although the bushes are productive and the nuts of good quality.

European Species.—The Old World chestnut, *C. sativa*, has been under cultivation almost as long as history goes. It was brought to America in the first century of its settlement by Europeans; but not until within the last 25 years has there been more than an occasional tree found on our shores. The accidental finding of a chance seedling, which was finally named Paragon and sent out to the public about 1887, and the bringing to notice of the Ridgeley shortly before that time, were the means of exciting the first general interest in chestnut culture in America. Both these kinds, and a great many more named varieties, are now being propagated and scattered far and wide. They are all of large size but not as sweet as our native chestnuts, and generally have bitter skins. The trees are of robust character and very productive, but more tender than our natives.

Japanese Species.—About the time that the European species was becoming popular in America attention was drawn to a number of seedlings from nuts that had been brought from Japan during several previous years. The most of them were larger than any that had been known before, either in this country or in Europe. Many of them are now named and widely distributed. Some of the smaller varieties are exceedingly early in ripening. Nearly all of them begin to bear at an early age and are even more productive than the average of the European species. In quality, the nuts of most of them are not quite so sweet as the European kinds. The habit of growth is less vigorous than that of other chestnuts.

From these two foreign species we have all of our varieties that, up to this time, are worthy of general cultivation. They vary from seed much as do most other improved varieties of fruits, etc., and grafting and budding must be practiced, which are exceedingly difficult to successfully perform on the chestnut, as is the case with all other nut trees. They will both unite fairly well with our native stocks; although sometimes the union is imperfect and the top breaks off.

Grafting.—The most successful method of propagating nut trees, so far as the writer has experimented or learned otherwise, is late bark-grafting This requires that the cions be cut before there is any possibility of the buds starting, and put in some very cool place until after the stocks have begun to leaf out. The stocks are then cut off as for cleft-grafting, but the bark only is split with a knife for an inch or more at the top of the stock. The cion is trimmed to a long wedge, all from one side. The point of this wedge is introduced under the bark at the top of the slit and gently forced down until the cut surface of the cion is even with the top of the stump. It is then tied fast with a string and the wound securely waxed. Large trees may be thus top-worked in their branches with considerable success. Small stocks should be grafted just under the surface of the ground and banked nearly to the top of the cion.

Stump Groves.—In several cases large tracts of chestnut stump lands have been grafted over to the improved varieties of the foreign species with good success. All other trees should be cleared away and only two or three of the strongest sprouts left on each stump. These should all be grafted and allowed to grow until it is sure that there will be a sufficient stand, when those that are not needed should be cut away. In future years more may be cut away to give the remaining trees ample room.

Chestnut Orchards.—The best results are said to be attained in chestnut-culture by planting grafted trees on open land, about 25 feet apart and in regular orchard form. This plan admits of giving the trees good tillage until they have attained large size, when grass may be sown and stock allowed to graze it, except when the nuts are falling. Such orchards are said, by those who have tried them in comparison with grafted sprouts, to yield more than twice as much per acre. Well-drained sandy or shallow lands are the best for the chestnut.

Weevil.—The worst feature of chestnut-culture is the weevil. In some cases the nuts are so badly infested that they are practically worthless. The eggs from which the larvæ develop are laid by a long-snouted beetle while the nuts are growing, and by the time they are mature the most of them are either hatched or nearly ready to hatch. By treating the nuts with the fumes of bisulphide of carbon the eggs or larvæ can all be destroyed. Scalding with boiling water for about ten minutes will also kill them, but it also destroys the germinative power of the nuts and necessitates drying them. See *Castanea* and *Chestnut*.

The Pecan (*Hicoria Pecan*).—*In the Wild State.*—Of all our native nuts the Pecan is the best. Its natural habitat is the lower Mississippi basin, from Iowa to the Gulf coast, but it will grow equally as well in any climate and soil of approximately the same character. The tree is almost as hardy as any of the other hickories, except some of its more southern varieties. In size the tree varies from medium, on land of ordinary fertility, to gigantic proportions on the rich river and creek bottoms. The nuts vary in size and shape from round and ½ an inch in diameter to oblong and 1½ inches in length. The kernels are exceedingly rich and sweet, and the shells usually thin. Pecans are found in all confectionaries, and bring almost as high prices as any of the imported nuts. The largest and thinnest shelled varieties are found in Louisiana and Texas. Millions of pounds are gathered annually in those states and sold to dealers, thus bringing a handsome revenue to many people of moderate means.

Under Cultivation.—The decrease of the wild product from the cutting down of the trees, and the better prices obtained from large, thin-shelled nuts, have induced the planting of pecan orchards. The nuts sprout readily, and the trees are of easy growth, with reasonable care, in proper soil and climate. In Texas there is one orchard of 11,000 trees planted on 400 acres and grown from the best nuts procurable. In Florida there is another of 4,000 grafted trees on 100 acres. There are many smaller orchards planted in nearly all the states from Virginia to Missouri and California, southward. The line of 40° north latitude is about the limit of successful pecan culture, and the region from 35° southward is much better. The nuts do not fill and ripen well where the growing season is short.

It has been learned that by cutting back the tops of wild trees (thus causing an abundance of sprouts), and then budding in August or September, large trees may be quickly transformed into such as will produce the highest grade of nuts.

Planning the Orchard.—There are two ways to make a pecan orchard. One is to depend on seedlings. If really choice nuts are planted there is a reasonable prospect of securing trees bearing somewhat similar nuts, and many follow this plan. The other is to depend on budded or grafted trees instead of seedlings.

There is also a division of opinion as to the advisability of planting the nuts where the trees are to stand and rearing them for a year or more in a nursery. Both ways are good, but each has its advantages. If the former of these plans is followed, then two or three nuts should be planted where each tree is to stand and a cedar or cypress stake driven at the spot. Pine stakes are said to induce worms to attack the little pecan trees. A still safer plan is to enclose the little seedlings in narrow boxes about a foot high, made of cypress boards. This secures them from the depredations of rabbits, which sometimes prove very destructive. By this plan there is no labor or danger of loss by transplanting. All but one of the trees should be removed after two or three years' growth. If the nursery method is followed, the transplanting should be done at one of these ages.

Propagation.—Grafted or budded trees are far preferable to seedlings, because of the certainty of the variety, convenience of gathering the nuts at one time, and the advantage of having an even and high grade to sell. The same difficulty is met with as in case of the chest-

1497. Cocoanut.
The most important of tropical nuts.

nut—the trouble and expense of securing grafted or budded trees. However, it has been found that both these methods of propagation are reasonably successful in skilful hands. Either the cleft-, tongue- or bark-graft will succeed, but all styles do better on small stocks just below the surface of the soil than above. Ring- and plate-budding are much more successful than the shield method. They have been profitably used in nurseries of young seedlings and on sprouts on large trees.

Planting and Cultivation.—The distance for planting should be not less than 50 feet between trees, because they get to be very large. It might be well to put them half that distance and cut out half when crowding begins. Thorough tillage will pay abundantly and should never be neglected while the trees are young. Farm crops, such as corn, cotton and potatoes, may be grown between the trees until they begin bearing, which is from 10 to 15 years from planting. Then the ground may be seeded to grass. See *Hicoria* and *Pecan*.

The Cocoanut (Fig. 1497).—*Where Grown in America.*—There is comparatively little territory on the continent of North America where the cocoanut will grow; viz., a small portion of Florida and the warmer coast regions of Mexico. In the warmer parts of California the climate does not seem to be sufficiently humid. In the vicinity of Lake Worth, Florida, there are many bearing trees, and along the east coast and adjacent islands from there to Key West, and as far north on the west coast as Charlotte Harbor, there are many thousands of cocoanut trees growing. In central Florida the climate does not seem to be suitable. Proximity to the sea in all countries seems to suit the cocoanut. It will flourish in almost any soil, although the richer the better, but a warm and humid atmosphere is indispensable.

Origin of Cocoanut-Growing in America.—The oldest cocoanut trees in Florida were probably chance seedlings which came from nuts that washed ashore from the sea long years ago. Such trees are very rarely found. There are also a few old trees that grew from nuts planted by settlers at Key West and other places along the coast. The chief cause of the impetus to cocoanut-growing was the wrecking of the Spanish bark Providencia laden with cocoanuts on the beach near Lake Worth, Florida, Jan. 9, 1878. Many thousands of the nuts were gathered from the surf and planted for many miles up and down the coast. The trees grew so rapidly and began to bear so soon, usually at from six to eight years from seed, that visions of wealth tempted many more into planting groves. One near Biscayne Bay consisted of about 4,000 acres, in which were 300,000 trees. Another at Cape Sable contained 42,000 trees, and there are many more of less extent.

Present Status.—Cold waves and occasional frosts have injured many of the cocoanut trees, in some cases killing them outright. In general, the trees bear good nuts in reasonable quantity, but in a business way the industry is uncertain, owing to danger from frosts and the cheapness of imported nuts. As an interesting novelty, the cocoanut in southern Florida is an eminent success. See *Cocos*.

There are three American publications devoted to nuts: "Nut Culture in the United States," 1896, being a bulletin of the Division of Pomology, U. S. Dept. Agric.; Fuller, "The Nut Culturist," 1896; Parry, "Nuts for Profit," 1897.

H. E. Van Deman.

NUT-GRASS. Mentioned under *Cyperus*.

NUTMEG. Treated under *Myristica*.

NUTTÀLLIA (Thomas Nuttall, professor of natural history at Philadelphia; author of "The Genera of North American Plants" [1818], "The North American Sylva" [1842], etc.). *Rosàceæ*. A genus of 2 species of northwestern American plants, one of which is the Oso Berry, *N. cerasiformis*. This is a shrub 6–12 ft. high, with white, 5-petaled fls. It is one of the earliest shrubs to bloom in spring. It is rarely cult. in the East and of doubtful hardiness, but is esteemed in England, where it is compared to a flowering currant. Botanically, however, it is nearer Prunus than Rubus. Generic characters are: fls. polygamo-dioecious; calyx between top-shaped and bell-shaped, deciduous; petals broadly spatulate; stamens 15, in 2 rows, 10 inserted with the petals and 5 lower down on the disk lining the tube; filaments very short; carpels 5: drupes 2–4, oblong.

cerasiformis, Torr. & Gray. Oso Berry. Shrub or small tree, 2–15 ft. high: lvs. broadly lanceolate; petiole 2–4 in. long: racemes shorter than the lvs.: fls. ½–1 in. across: fr. blue-black, 6–8 lines long; flesh bitter; stone somewhat compressed. Moist places, Calif. Gn. 34, p. 78. G.C. II. 19:309; III. 19:489.—Said to "exhale a

hydrocyanic odor." It endures the winter under protection at the Arnold Arboretum, Boston.

N. splèndidum, adv. 1889 by John Saul, is presumably an error. Probably some other genus.

NYCTERÍNIA. See *Zaluzianskya*.

NYMPHÆA (from *Nympha*, in Greek and Roman mythology, a nature-goddess). Syn., *Castalia*. *Nymphæàceæ*. WATER-LILY. POND-LILY. Figs. 1498–1502. The most spleudid of aquatics (except Victoria), inhabiting the north and south temperate and tropical zones. About 32 well-marked species, with numerous local varieties and many cultivated hybrids. Herbs, perennial by horizontal or erect rootstocks or tubers, rooting in mud, covered by 3 in. to 6 ft. of water (rarely in bogs not submerged): lvs. floating, or when crowded rising a few inches above the water, round or oval, entire or dentate or sinuate, fissi-cordate, often sub-peltate, 2 in. to 2 ft. in diam.: fls. mostly showy, white, yellow, blue and red, in all shades, 1–12 or 14 in. across; sepals 4; petals and carpels many; stamens very numerous; pistil with a broad cup-like depression in the center of the fl., surrounded by a ring of fleshy processes, the carpellary styles, and with a knob at the center.

The petals and stamens of Nymphæa appear to be attached to the sides of the ovary; but this surface is to be considered as the outside of a cup-like receptacle, its cavity being completely filled by the radially placed carpels, with whose backs it is fused. Several species show easy gradations from sepal to petal and from petal to stamen, thus illustrating the homology of floral parts. The peduncles and petioles are traversed by a number of longitudinal air-canals, from whose walls star-shaped cells and rounded cell-groups project inward; in the walls of these stellate internal hairs are imbedded numberless minute crystals of calcium oxalate; they are objects of great beauty in microscopical sections. The distribution of these, as also of the air-canals, differs in different species. Three types of leaf may be distinguished: (1) very thin and fragile submerged leaves on short petioles; (2) floating leaves, thicker in texture, with stomata and palisade cells on the upper surface only; (3) aërial leaves, leathery in texture, sometimes, at least, bearing stomata on the under surface.

The leaves come from the rhizomes in spiral orders of varying complexity, from two-fifths up; the growing apex of the stem is protected by the colorless stipules and a dense growth of long, fine hairs. The roots spring usually from the bases of the leaves. Flowers are extra-axillary, arising as members of the leaf spirals or in a spiral of their own. The rhizomes of species which dry off in the resting season (Lotos, Hydrocallis, Lytopleura) become protected by a strong corky bark; others remain continually in a state of more or less active growth.

Habits of Opening.—The flowers of every species open and close at a particular time each day, so that in a pond with 18 or 20 kinds there is some change taking place at almost all hours. The hours of blooming are quite regular, though the tropical species are more sluggish in cool weather, and the hardy ones are irregular in very hot times. Each flower opens in from one or two to five or seven successive days (or nights), being about an hour later to open and an hour earlier to close on its first than on subsequent days. The flower then goes down into the water by a spiral coiling of the peduncle (or simply bending over if in shallow water) where the seed ripens. When in 6 to 10 weeks the pod matures and bursts, the seeds rise to the water-surface and float for several hours by means of a buoyant aril; this finally decays and drops the seed at some distance from the parent. To secure these, the floating seeds may be dipped up in a wire sieve, or better, the pods may be inclosed in muslin or cheese-cloth bags before ripening, all of the seeds being thus secured.

The Hybrids.—The species of a single group hybridize quite readily among themselves, and in the *Lotos* group the hybrids are more or less fertile. By means of this condition all shades of color have been obtained, from the pure white *N. Lotus*, var. *dentata*, to the dark crimson-red *N. rubra*. In this group and in *Castalia*, varieties have so multiplied of late and fanciful names have been so freely given that an accurate classification of all of them is no longer possible. In the *Brachyceras* group, hybrids occur almost certainly if *N. Zanzibariensis* is grown in the same pond with others of the group; thus have originated some very fine varieties. Outside of single groups only *Castalia* and *Xanthantha* have yet been interbred. Between the apocarpous and syncarpous species, the writer ventures to suggest, a hybrid would be impossible. Authorities differ as to the best time to transfer pollen; certain it is that the flowers are pistillate on the first day of opening, the pollen being shed on succeeding days, or late on the first day. Some say that pollination should take place in the early morning hours, about daybreak; others consider the time most favorable just as the flower is closing for its first time.

Trouble with the Names.—Great confusion has existed from the beginning in the naming—alike scientific and popular—of certain species of Nymphæa, partly from carelessness, partly because of the great variability of some species. A good degree of order was introduced by Caspary, though he left the matter still incomplete. *N. cærulea*, minutely described by Savigny, from Egypt, in 1802 (Ann. Mus. Paris. I p. 366 ff.), was immediately confused with *N. Capensis*, of South Africa, by the editor of B.M. and several other writers. It was also confounded with the very similar *N. stellata*, of India. Caspary, in Bot. Zeit. 1877, p. 200, finally set the matter straight, though American gardens are as yet not all corrected. *N. ampla* and *N. Amazonium* were confused because De Candolle's original specimen of *N. ampla* consists of a leaf of the first, with a flower of the second species; and *N. Amazonum* has been distributed in this country under the wrong name. Both are fully described by Caspary in Martius' Flora Brasiliensis (Fasciculus 77). *N. blanda* of our gardens is probably a form of *N. tuberosa*. The term *N. blanda* was first used by G. F. W. Meyer (1818) in a most faulty description of a member of the *Hydrocallis* group. The name was attached also to two other species of this group by later writers. See full description and synonymy in Fl. Brasil., l. c.

The True Egyptian Lotus.—Among common names the term "Lotus" has been remarkably misapplied. It seems to be consistently used among us for the genus Nelumbo, *Nelumbo nucifera* being generally styled "Egyptian" or "Sacred Lotus." Historically this is entirely wrong. Nelumbo is not native in Egypt, and is not now found there in a wild state. It was cultivated extensively along the Nile in the Roman period, probably for food, and the flower is supposed to have furnished one form of capital of the Egyptian columns. It is a native of southeastern Asia; is found near temples and carved on the walls of cave-temples in Hindustan, showing a veneration, which it shares, however, with *Nymphæa stellata*, *rubra* and *Lotus*. Nelumbo seems to have been regarded as sacred about temples in Japan and China. In Egypt, however, *Nymphæa cærulea* and *N. Lotus*, the "blue lotus" and "white lotus," are indigenous. The root (rhizome) of the former is said to have been pointed out as edible by Isis—or by Menes; its flowers, buds and leaves are often depicted on the monuments, the first sometimes in color. The flowers are figured among offerings under the IV. dynasty (3998–3721 B.C.), and the plant is certainly known from the V. dynasty. Petals of this and of *N. Lotus* were found in the tomb of Ramses II., the Pharaoh of the Israelitish captivity. *N. Lotus* was less regarded than *N. cærulea* in Egypt, though an object of profound veneration in India. Herodotus and other ancient writers speak of these Water-lilies indiscriminately as the "lotos" of the Egyptians. With these facts, and the additional one that, except as referred to above, Nelumbo never appears in Egyptian carvings, the identity of the sacred lotus cannot be doubted. But the erroneous use of the word lotus is deeply rooted, and may never be supplanted. Personally, the undersigned would not attempt to uproot it, but only to remember that the so-called "Egyptian Lotus" is not the plant of the tombs and monuments. (The lotus of Tennyson's poem, "Lotus Eaters," is still another plant, a shrub or tree which hangs out over the water; and the genus Lotus (q. v.) is distinct from all these.)

Economic Value.—The seeds and root-stocks of several Water-lilies, being very rich in starch, are used for food in parts of Africa, Asia, Australia and tropical America. The white-flowered species of Europe and America have been reputed medicinal. The herbage of all the species contains considerable tannin; nine substances of this class have been isolated from *N. alba*.

The Marliac Hybrids.—Two types of hardy, free-flowering hybrids akin to *N. alba* and its variety *rubra*, but of uncertain parentage, have been introduced in the last 10 or 12 years, one of sturdy habit, raising its lvs. (4–8 in. across) and fls. (3–6 in. across) well out of the water when crowded, the other slender in growth, the lvs. (3–6 in. across) and fls. (2½–4 in. across) usually floating. Most of these superb varieties were introduced by M. Latour-Marliac, of Temple-sur-Lot, France, whose methods, however, remain a mystery. It seems highly probable that excellent culture combined with careful selection, and wise hybridization have brought about these magnificent results. The first group seems to involve only *N. alba* (type) and *N. alba*, var. *rosea*. The second starts with a hybrid, probably of *N. alba*, var. *rosea* and *N. tetragona*, giving *N. Laydekeri*, var. *rosea*, to which is added, in varying degrees, blood of *N. alba*, var. *rosea* and *N. Mexicana*; but this does not by any means account for the whole group. Nearly all of both groups are entirely sterile. Believing that *N. alba*, and *N. alba*, var. *rosea*, have given a decided tone to both groups, we have described them as an appendage to this species, though some have more the habit of *N. tetragona*.

Important Species.—The following account, which contains 93 varieties and about 30 synonyms, will seem rather formidable to the beginner, but the species of the first importance are only 7 in number: *N. Lotus*, *rubra*, *odorata*, *tuberosa*, *alba*, *Capensis* and *Zanzibariensis*. The great majority of the other names represent garden varieties and hybrids. It is impossible for any form of arrangement to be clear and logical on the one hand, and exhibit natural relationship on the other, at least, not in a genus so greatly modified in cultivation. However, the true species are prominently indicated by bold-faced type and indention as usual, while their derivatives are thrown into the background.

HENRY S. CONARD.

WATER-LILIES OR NYMPHÆAS are among the most royal, gorgeous, diversified and universally admired plants in cultivation. No class of plants in our public parks can compete with them in attracting the people. Moreover, America is the most highly favored country in the world for the cultivation of aquatic plants. Ours is the only country which can have so rich and continuous a display of aquatics in flower from April to October in the open without artificial heat.

The Procession of the Water-lilies.—In our parks and private gardens are to be seen, flowering early in spring, all our native Nymphæas, and others from Europe and Asia. The species begin to flower in April and continue until early fall, when a number of the hardy hybrids continue to flower uninterruptedly until the end of the season. In the central states and southward the hardy varieties decline when tropical weather sets in, and the nights and days are hot. In the eastern states, and especially near the coast, where the nights are cool, the season is much longer, and the color of some of the pink varieties is more intense. Following the hardy Nymphæas come the Nelumbiums in all their oriental splendor, brightening the summer season, and bridging over the declining period of the hardy Nymphæas, and the approaching season of the tropical Nymphæas, which arrive at maturity toward the latter end of July or beginning of August, and continue until fall. Finally the grandest of all aquatic plants, *Victoria regia*, may be seen in America growing in a natural pond, and producing its chaste flowers as late as the middle of October.

The American Climate and American Species.—America is rich in native species of Nymphæa, and it is the only country which has native white-, pink- and yellow-flowered species.

Of the American Nymphæas there are about 5 that are best known. The common white Water-lily is *Nymphæa odorata*. Its variety *rosea* is the Cape Cod Pink Water-lily. *N. tuberosa* (Syn. *N. reniformis*) is a white-flowered species, inhabiting the western lakes. The yellow kind, *N. flava*, is indigenous to Florida and other southern states, but is hardy in New Jersey and southern New York. Another southern kind is the white-flowered *N. odorata*, var. *gigantea*. In addition to the above well-known kinds, there are several distinct forms and hybrids.

The commencement of the cultivation of aquatics in America led to the commingling of species, especially of *N. odorata* and *tuberosa*. The result is that in several sections are to be found many similar varieties, and forms of both white and pink, some of which are valuable, being distinct in color and having large, handsome, fragrant flowers, while a host of others are worthless, so far as distinct varieties are concerned. *N. tuberosa* was known as the largest and purest white Water-lily, distinct in foliage, flowers and rootstock. This species has proved to be the most susceptible of cross-fertilization. One great hindrance to the cultivation of such half breeds, is that most of them produce seed. The seedlings are either white or pink, and seldom, if ever, like the parent plant. There are in different sections of the country distinct forms of *N. tuberosa*, some having long, narrow petals and slightly fragrant flowers, others again having broad, incurving petals, forming handsome cup-shaped, highly fragrant flowers; still others have very full flowers, quite double, the numerous petals crowding each other until the reflexed sepals inclose the stalk, forming spherical flowers like balls of snow. *N. tuberosa*, in any of its forms, should not be planted in a small pond with other Nymphæas, for it is such a rampant grower that in a short time it will smother the less vigorous kinds. This species delights in plenty of space, and water 2 to 3 feet deep, with soil of a tenacious character. However, it will thrive in almost any soil, and is well adapted for naturalizing in lakes and ponds. Attempts at naturalizing or cultivating on a small scale have not been very satisfactory; but the species will well repay any extra care to establish it in desirable localities.

Foreign Species and Recent Triumphs in Hybridization.—Two or three species are indigenous to continental Europe, notably *N. alba*, the well-known English white Water-lily, *N. candida*, the white Bohemian Water-lily and *N. alba*, var. *rosea*, the Swedish Water-lily. The last named is the only distinct or true red-flowered, hardy species. Still another species, which has played a very important part with specialists of the present day, is *N. tetragona* (*N. pygmæa*), from China and Japan.

N. odorata was introduced into England during the eighteenth century, and was probably the first foreign Nymphæa to reach that country. Other species followed later, mostly tropical; but, although the English people were ardent horticulturists and lovers of the beautiful in nature over a century ago, Nymphæas never became popular, and remained a neglected class of plants until a few years ago, when M. Marliac, of Temple-sur-Lot, France, conceived the idea of crossing the English white Water-lily with the well-known Cape Cod pink Water-lily, and the Florida yellow variety. Nothing in the horticultural world has created more surprising results in the blending of the American and English species. These species have been the progenitors of numerous varieties, which have made this class of plants the most popular and desirable of all aquatic decorative plants, and within reach of all. Their popularity has kept constantly increasing and ever brightened by new additions. America, too, has contributed its quota to the list of novelties, and some of these are unsurpassed by any European introductions.

The General Principles of Water-lily Culture.—From the apparently simple conditions under which our native varieties are found growing, many amateurs have concluded that all these plants require is water and possibly some mud to keep the roots in. Many attempts have been made to grow these plants in pails and tubs, with the inevitable result—failure. Professional gardeners, also, have made grievous errors, for, while they have used every means to secure fine specimen plants of flowers, vegetables and luscious fruits, they have usually given meager attention to Water-lilies, and have not supplied half their wants. Water-lilies, all Nym-

phæas, succeed best when grown, as near as possible, under their existing natural conditions; these are a rich alluvial soil in abundance, water, and clear uninterrupted sunlight. Where natural ponds exist these conditions are found, but often there is a deficiency of light, caused by shade trees. Let the trees remain, but select open spots for the Nymphæas. They may be planted on the margins of sluggish streams, in bays and sheltered nooks.

Construction of Artificial Ponds, etc.—Where artificial ponds are resorted to, the most satisfactory method is to build solid walls of masonry, with a concrete bottom, provided with an outlet and overflow. In all cases make the pond as large as existing means will allow, not for a moment considering it possible to be too large. One method of providing for the sustenance of these plants is to place a layer of soil in the bottom of the pond from 9–12 or more inches deep. This will suit the plants admirably. Artificial ponds are usually constructed in a conspicuous spot, where everything is required to be well kept. In such situations it is necessary occasionally to take off some dead leaves, or cut a few choice flowers, and if they cannot be reached from the edge of the pond, the attendant must wade in after them. The result is that the water, which should always be clear, is muddy, and when it settles there is a muddy deposit on the leaves that makes them very unsightly. Moreover, this treading in the soft soil breaks numerous roots. To avoid these and other attendant evils place the soil in boxes from 3–4 feet square, and 1 foot deep, and in these plant one single plant of the vigorous and moderate growers, allowing ample space between the boxes. One plant of any tropical Water Lily grown in such a box will require from 50 to 100 square feet of water surface, as will also the strong varieties of hardy Nymphæas, since these may remain two years undisturbed, although some of these are best replanted every season.

The pond should be 2 to 2½ feet in depth. The soil should be a strong loam, the top-soil from a pasture composted with cow manure in proportion of one-third. This should be prepared six months, at least, before planting time. This soil is suitable for all aquatic plants. In any case, when filling the boxes or placing the soil in bottom of pond, tread moderately firm and cover with an inch of sand.

The water may be spring water, rain water or that from any available source. The clearest spring water will soon turn green from exposure to the sun and air, but after fermentation settles clear. Do not place the plants in a newly constructed pond or basin immediately after it is finished, as the caustic property of the cement will injure the plants. Let the water stand a few days, or if the basin is small, the water may be changed. Planting of the hardy varieties may be done in April and May, according to the latitude and earliness or lateness of season. The conditions should be conducive to active growth at once. Tropical Nymphæas should not be planted until there is evidence that summer has come. Hardy Nymphæas may be planted during spring and summer; late planting is better than deferring till next spring, as the plants under such conditions will get established before autumn closes, and the plants will start naturally in spring, receiving no check.

1498. Nymphæas in an effective and natural setting.

The above method of construction and cultivation is to be commended, but other methods are adopted with a fair amount of success, but with attendant evils which are discouraging and at times very annoying and costly. Tanks or artificial ponds may be constructed with cement, digging the pond the desired size, having sloping sides and afterward lining the same with concrete and finishing with a facing of cement. However, such a pond will not stand the effects of hard freezing weather even if protected; and what is worse, the new or freshly removed soil will settle during the season, and the pond is very apt to spring a-leak. Some morning the pond is

likely to be found empty of water just as the plants are showing their first flowers.

Another method of construction which is better than the preceding is to line the pond with well-tampered clay, from 4–6 in. thick, afterward covering with 2 in. of sand. Such a pond can be made water-tight, but the sides will wash and repairs are needed; the water is muddy and the plants are dirty and anything but a thing of beauty and a joy forever.

There are yet the advocates for tub culture. Yes, plants will grow in tubs, and as soon as the plant-food is exhausted, which is often at an early date, the plants exist awhile and then draw out a miserable, exhausted and discouraging career.

Fountain basins are often made the receptacles for Nymphæas. There they may be grown if the right conditions are accorded them, but there must not be a stream or spray of cold water running all the time, as the water can readily be made cold, chilling the plants and checking their growth.

Enemies.—Nymphæas have insect pests like other cultivated plants. Aphides are sometimes troublesome. The best remedy is their natural enemy, the "lady bugs" or "lady birds." A colony of these voracious insects makes short work of the aphides, as do also the lace-winged flies. An insect of recent acquaintance with Nymphæas is a leaf-miner, the larva of a small fly, which cuts channels through the leaf in all directions. Sometimes only a few of these are in evidence, at other times the leaves are fairly alive with them. The trouble is easily detected The marks suggest Japanese writing or the efforts of youthful artists. A simple and effective remedy is kerosene emulsion, applied with a fine spray at evening after the flowers are closed. Another troublesome insect has its home in Florida, and has come north to spend the summer in a favored clime. This is a leaf-cutter, *Hydrocampa proprialis*. The larva cuts out pieces of the leaf and hides between two pieces, which makes a kind of tent. In this tent the larva moves about. At first it moves slowly, but as it nears maturity the larva becomes ravenous and then eats the surface of the leaves near the center, and cuts off much larger pieces of the leaf for camping-out purposes. The best remedy for this pest is a lamp trap for the mature insect. Frogs and dragon-flies will catch numbers of them.

Nymphæas are also subject to a fungous disease, a leaf-spot which is easily discerned after a spell of warm, humid weather. After such a spell of weather, followed by bright sunshine, the leaves are scorched and crumpled, and as a result, the plant is sadly crippled by being denuded of its foliage; new leaves are weak and smaller, and so too are the flowers, if indeed there are any. This disease must be checked at once or the plants will be severely set back, if not ruined. The only remedy is Bordeaux mixture, or any of the various mixtures with sulfate of copper as the basis. Use a fine spray, and dilute the mixture to half the strength recommended for most plants. It is best to spray twice with a weak solution rather than to spray once with too strong a solution and to damage the foliage. WM. TRICKER.

WATER-LILIES IN CALIFORNIA.—The culture of Nymphæa in California presents fewer difficulties than in the eastern states. The varieties which are hardy in the East flourish equally well and bloom for a longer period. In frostless localities, especially where the lemon tree is free from injury, such tender varieties as *Nymphæa Devoniensis*, *N. dentata* and *N. Zanzibariensis* may be left in the open pond during winter. In colder localities the tubers should be removed to warmer quarters in November to remain until spring. If a greenhouse is not available, a small pool built in such a manner that it can be covered with hotbed sash will afford suitable protection. Very little room is needed for these when they are dormant. The manner of cultivating both the hardy and tender varieties is much the same in California as in the eastern states. For growing a small collection a pool 8 or 10 feet across may be made by excavating 2 or 3 feet, making the walls of concrete, brick or stone, and covering the bottom with concrete. The best quality of cement should be used for all the work. An overflow pipe should be put in and so arranged that the pool may be emptied when occasion requires. Basins 20 or 30 feet in diameter, or even larger than this, are desirable for growing a good collection. In a small pool, wooden boxes 10 inches deep and 18 inches to 2 feet square may be used to hold soil for the plants. In a large basin some of the boxes may be 3 or 4 feet square. While most aquatics will flower freely in contracted quarters, they will attain greater perfection and produce much larger flowers if they have abundance of room both for the roots and the leaves.

The majority of these plants are gross feeders, and it is well-nigh impossible to make the soil too rich for them. It is not necessary to go to a swamp or natural pond to obtain what is suitable. Any soil which will grow good vegetables will, if properly enriched, grow Water-lilies. A compost, consisting of two-thirds good soil and one-third thoroughly decayed cow or stable manure, with a sprinkling of bone meal, is recommended. A dark friable loam, which is intermediate between "adobe" and sandy loam, is desirable for this purpose. The tenderest varieties, such as *N. Devoniensis* and *N. dentata*, will flower for a long period without any forcing; but if started into growth in March in a greenhouse or hotbed and planted in the pond in May, there will be a great gain in the length of the flowering season. The soil for the tender varieties should be renewed every year, and that for the hardy ones every two years.

If aphides or the worm known as the leaf-roller make their appearance the leaves should be sprayed with kerosene emulsion very much diluted, using 1 part emulsion to 15 of water. If large ponds or lakes with a natural earth bottom are used for growing Water-lilies, care must be taken that noxious weeds do not get a foothold. Cat-tails (*Typha latifolia*) and "tules" or bulrushes are troublesome if not destroyed when they first make their appearance. In California the number of tropical and subtropical trees, shrubs and plants which may be planted out permanently is very great. Palms, both fan-leaved and feathery, giant bamboos, Musas, Strelitzias, Papyrus, giant grasses, Fatsia and Caladiums are among the things which can be used to ornament the surroundings of the water-garden.

EDMUND D. STURTEVANT.

THE GENUS NYMPHÆA divides itself readily into 2 main divisions, which again are subdivided into 6 groups, according to Caspary (Ann. Mus. Lugd.-Bat. 2, p. 240 ff.; Engler-Prantl, Pflanzenfamilien 3, 2, p. 7 ff.):

Section I. *Syncarpous Nymphæas*, i. e., carpels entirely fused together. (*Symphytopleura*, Casp.)

Subgenus I. LOTOS. Sepals prominently veined: a space between the insertion of the petals and stamens: stamens broad, flat, rounded at apex: carpellary styles linear: lvs. sharply dentate: rhizome ovate, stoloniferous.—Tender night-bloomers: fls. red or white on strong scapes 3–12 in. above the water, opening on 4 successive nights. Two or 3 species in S. Europe and Asia and N. and Central Africa.

Subgenus II. HYDROCALLIS. Sepals not evidently nerved: carpellary styles long, club-shaped: petals in alternating circles of 4: stamens much as in CASTALIA, all opening about the same time: rhizome ovate, stoloniferous.—Tender night-bloomers: fls. creamy white. About 9 species in tropical America.

Subgenus III. XANTHANTHA. Sepals not evidently nerved: plant spreading rapidly by runners (except in hybrids): fls. yellow throughout; stamens as in CASTALIA: rhizome short, erect.—Day-bloomers, half-hardy. Two species in S. North America.

Subgenus IV. CASTALIA. Sepals not evidently nerved: carpellary styles flat, not clavate: outer stamens petaloid, becoming narrower inward: inmost stamens first to ripen, their filaments short, narrower or but slightly wider than the anthers: rhizome horizontal (except in *N. tetragona*), with no bark or other protection against drought.—Hardy day-bloomers: fls. white, pink or red. Mostly natives of temperate climates. About 6 species in Europe, N. Asia, and America.

Section II. *Apocarpous Nymphæas*, i. e., carpels free at the sides, united at their edges to the central column of the fl. and at their backs to the receptacle.—Outermost stamens ripening first, inmost last: rhizome ovate, stoloniferous.—Tender day-bloomers: fls. on strong

scapes 4–12 or 14 in. above the water. (*Lytopleura*, Casp.)

Subgenus V. BRACHYCERAS. Outermost stamens with an appendage above the anther: carpellary styles short, triangular: fls. white, blue or pink.—About 12 species in the tropics all round the world.

Subgenus VI. ANECPHYA. Stamens all slender, half as long as the petals, almost without any appendage: carpellary styles wanting: fls. blue, rosy or white. One species in Australia.

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SECTION I. SYNCARPOUS NYMPHÆAS.

SUBGENUS I. LOTOS.

A. *Fls. white or light pink.*

1. **Lòtus**, Linn. (*N. édulis*, DC. *N. thermàlis*, DC., of the hot springs of Hungary). WHITE LOTUS. Fig. 1499. Lvs. orbicular, dark green above, under surface brownish, smooth or slightly pubescent; diam. 12 to 20 in.; fls. white, the broad outer petals suffused pink, 5 to 10 in. across, open 7:30 P. M. to 11 A. M.; sepals pure green; petals concave, 19 or 20; stamens 96–103, yellow; anthers shorter than the filaments. Egypt. B.M. 797. F.S. 7:706–7.

2. Var. **dentàta**, Schumacher & Thonning (*N. Ortgiesiàna*, Planch.). Lvs. glabrous or somewhat puberulent beneath: fls. pure white, 8 to 10 in. across, open until 1 P.M.; petal narrower than in the type, ovate, opening out horizontal; anthers longer than the filaments. Central Africa, Sierra Leone. B.M. 4257 (as *N. dentata*). F.S. 6:627–8.

3. Var. **pubéscens**, Willd. Lvs. densely pubescent beneath: fls. white; outer petals tinged pink. India.

GARDEN VARIETIES OF NYMPHÆA LOTUS.

N. Lotus and varieties seed freely, and are valuable seed-parents for hybrids, of which the following may best be classed here: 4. *Jubilee*, with fls. delicate pinkish white: lvs. blotched with brown, crumpled at margin. Distributed by Henry A. Dreer, Riverton, N. J., in 1899.—5. *Smithiàna* (N. Lotus × N. Lotus var. dentata). A shade more pink than 4: petals broadly ovate: lvs. plain dark green, lying flat at margin. Distributed by W. Tricker from Clifton, N. J., in 1893.—6. *C. delicatissima* (N. Lotus var. dentata × N. rubra). Light pink; a shade darker than 5: lvs. slightly bronzy, a little crumpled at margin. Distributed by W. Tricker from Clifton, N. J., in 1894.—7. *Deaniàna*. Hybrid same as 6. Pure light pink; darker than 6: sepals deep rose pink; petals broadly ovate; stamens red: lvs. dark green, scarcely bronzy, much crumpled at margin. Sent out by W. Tricker, from Clifton, N. J., in 1894.—8. *Lævia* (N. Columbiana × N. Smithiana). White or nearly so: lvs. bright green, Var. *colòrans*, smaller than type: fls. shaded pink: lvs. with open sinus. Originated with O. Ames, N. Easton, Mass., 1900.—9. *Eastonènsis* (N. O'Marana × N. Smithiana). Lvs. dark green, bronzy when young; sinus wide: fls. white. Originated with O. Ames, N. Easton, Mass., 1900.

AA. *Flowers red.*

10. **rùbra**, Roxbg. Lvs. orbiculate, reddish brown, bronzy, becoming greenish, pubescent beneath, 12 to 18 in. across: fls. deep purplish red, 6 to 10 in. across, open 3 or 4 nights from 8 P. M. to 11 A. M.; sepals dull purplish red, 7-nerved, never opening more than 10° above horizontal; petals 12–20, narrowly oval, rounded at apex; stamens about 55, cinnabar-red, becoming brownish. India. B.M. 1280. F.S. 6:629.—Only distinguishable from *N. Lotus*, var. **pubescens**, by color of fls. The two run into each other and may not be specifically distinct.

11. Var. **ròsea**, Sims. Lvs. bronzy green, blotched with brown; fls. large, magenta to dark red, open from 8 P. M. to 10:30 A. M.; petals narrow, pointed; stamen tips orange-brown. India. B.M. 1364.

GARDEN VARIETIES OF NYMPHÆA RUBRA.

FIRST GROUP.

12. *Columbiàna*, with deep red fls., darker than the type, of medium size (6 in. across): foliage dark bronzy red. Chance seedling from N. rubra. Sent out by W. Tricker from Clifton, N. J., in 1894.—13. *George Huster*. Fls. deep red, 8–10 in. across, closing about 11 A. M.: lvs. bronzy green. Sent out by Henry A. Dreer from Riverton, N. J. in 1899.—14. *Diana* (N. Sturtevantii × Amazonum). Intense magenta shaded with crimson: lvs. deep olive-brown, sinus open. A.G. 21, p. 517. Var. *grandiflòra* is larger and deeper in color. Originated with O. Ames, N. Easton, Mass., 1900.

SECOND GROUP.

15. *Devoniènsis*, Hook. Fig. 1500. Lvs. dark bronzy green, moderately peltate, lying flat on the water, 18 in. across; under surface greenish brown, puberulent: fls. pure red, 10–12 in. across, open from 8 P. M. to 1 P. M. of next day; petals ovate, 4 or 5 in. long by 1½ in. wide. B.M. 4665. The first hybrid of note (if hybrid at all); said to be N. Lotus × N. rubra, raised at Chatsworth, Eng., in 1851. A universal favorite.—16. *Boucheàna*. Very near 15; hybrid(?), of same parentage; color of fls. a little lighter. F.S. 10:1033–4.—17. *Ortgiesiano-rubra*. Much like 15: fls. dark red. F.S. 8:775–6.

1499. Nymphæa Lotus.

Redrawn from the old figure in Botanical Magazine (1804), showing an historical picture of the true white Egyptian Lotus.

THIRD GROUP.

18. *O'Maràna*. Lvs. bronzy green, margin occasionally crumpled: fls. 10–12 in. across, open from 7:30 P. M. to 1 or 2 P. M. of next day; sepals reflexed when fully open; petals pinkish red, with a nearly white streak up the middle: stamens orange. N. Lotus × N. Sturtevantii, sent out by P. Bisset, Washington, D. C., about 1894.—19. *Arnoldiàna*. Much smaller than 18: lvs. somewhat crumpled: petals crumpled. N. Lotus var. dentata × N. rubra, by G. W. Oliver, Washington, D. C.—20. *Niobe* (N. rubra × ————). Bright carmine pink: lvs. undulate and dentate margined, dark green above, sinus open. Originated with O. Ames, N. Easton, Mass., 1900.

aaa. *Fls. pure pink.*

Garden Hybrids of N. Lotus and N. rubra.

21. ***Kewénsis***, Hook. f. Lvs. orbicular, dark green with a few brown patches, slightly bronzy, lying nearly flat on the water, rather broadly peltate: fls. 6 to 8 in. across, light pink; petals broadly ovate; sepals light brownish green. N. Lotus, var. dentata × N. Devoniensis, raised at Kew in 1885. B.M. 6988. Said to have died out, but a plant of that name and description is still found in American gardens.

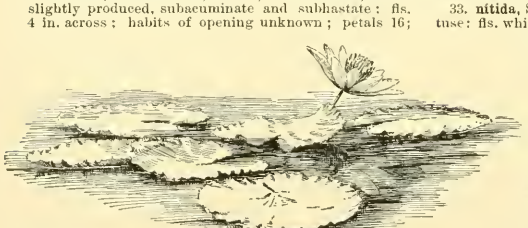
22. ***Sturtevántii***, Hort. Lvs. light bronzy green, rather broadly peltate, much crumpled at margin: fls. 8–12 in. across, quite double, pure pink to bright red, closing about 11:30 A. M.; petals very broad, concave, incurved; stamens incurved, tips light brownish orange. G.F. 7:355. A huge massive flower; varies greatly in color of leaf and bloom, according to culture. Chance seedling from N. Devoniensis, raised in 1884 by E. D. Sturtevant at Bordentown, N. J.—23. *rubicúnda*, Ames (N. Sturtevantii × N. Lotus). Deep rich pink: lvs. dark green. Originated with O. Ames, N. Easton, Mass., 1900.

Subgenus II. Hydrocallis.

24. **Rudgeàna**, G. F. W. Meyer (*N. blánda*, Planch., not of gardens). Lvs. elliptic to suborbicular, 18 in. long, margin coarsely and irregularly sinuate-dentate: fls. 3–6 in. across, imperfectly open 2 or 3 nights from twilight until dawn. Usually only the sepals and 4, 8 or 12 outer petals open, the remaining parts forming a closed ovoid bud; occasionally a slight aperture is formed by drawing apart of the tip of the bud, which occurs before midnight. Petals usually 16–20; stamens 43–83. Trop. Amer. Flora Brasiliensis 77, pl. 32, 34, 35, 38. Not in cultivation here.

25. **Amazónum**, Mart. & Zucc. (*N. ámpla*, of American gardens). Lvs. ovate, entire; lobes rounded; upper and lower surfaces spotted brownish or blackish, under surface reddish brown; petiole with a ring of long hairs at the point of joining the leaf: fls. 3–6 in. across, imperfectly open 1 or 2 nights; the bud opens about half and closes again between 3 and 6 A. M. the first night; the second night the sepals and outer row of petals open about 7 P. M., the other parts remaining as a tight, white bud until 3.30 A. M., when the fl. opens fully from 4.30 to 5 A. M., then closes by 6.30 A. M. and draws down into the water; petals usually 20; stamens 93–297. Tropical America. Fl. Brasil. 77, pl. 35. B.M. 4823.

26. **blánda**, G. F. W. Meyer (not of American gardens). Lvs. small, membranous, entire, suborbicular; lobes slightly produced, subacuminate and subhastate: fls. 4 in. across; habits of opening unknown; petals 16;



1500. Nymphæa Devoniensis (× 1·20). No. 15.

stamens about 65. Central and S. Amer., in the tropics. Fl. Brasil. 77, pl. 36.—Not in cultivation.

Subgenus III. Xanthantha (and hybrids).

A. *Spreading by runners* (*type species*).

27. **Mexicàna**, Zucc. Floating lvs. ovate, margin obscurely and finely sinuate, dark green above, beautifully blotched with brown; under surface dark crimson-brown, with small blackish dots, when crowded the lvs. rise 3–5 in. above the water, are orbicular, cup-shaped by overlapping of the straight sinus-margins, entire, 3–5 in. across, dark green and shining above, under surface bright green, with fine purplish brown mottlings: fls. 4 in. across, raised 4–5 in. above the water, bright canary yellow, open from 11 A. M. to 4 P. M.; petals 23, grading in size and shape insensibly into the stamens, which are about 50, light golden-yellow; rhizome erect, tuber-like, discoid, plane beneath, 3–5 in. in diam.; runners terete, ½ in. thick, white, rooting at the tip and sending up lvs.; the young plant flowers in a few weeks and again sends out runners. Mexico.

28. **flàva**, Leitner. Like 27, but more slender, weaker grower, less free bloomer, fls. paler yellow. Probably only a variety. Florida, in St. John's and Miami rivers. B.M. 6917.—Hardy as far north as New York, "in 2 ft. of water, covered with boards and a few leaves;" Gerard, in G.F.

AA. *Without runners* (*hybrids*).

29. *odoràta*, var. *sulphùrea*. Lvs. all floating, 4–6 in. across, like N. odorata, but blotched with brown: fls. light yellow, 4–5 in. across, borne 2–4 in. above the water; open during the morning. One of Marliac's hybrids, doubtless N. odorata × N. flava. Hardy. Shown in Paris in 1889.

30. *tetrágona*, var. *helvòla* (N. pygmæa, var. helvola, Marliac). Lvs. floating, oval, 3–4 in. across, similar in shape to those of N. tetragona, blotched all over with brown: fls. floating, small, yellow, 2 in. across, open during the afternoon. Hybrid, probably N. tetragona × N. Mexicana. Hardy. Introduced into America about 1892.

31. *Marliàcea*, var. *chromatélla* (N. tuberosa, var. flavescens of Kew.=N. Marliacea). Floating lvs. orbicular, much blotched with brown, 3–8 in. across; when crowded the lvs. rise as much as 8 in. above the water, are dark green above, lighter beneath; petioles sometimes with longitudinal brown stripes; fls. bright yellow, 3–6 in. across; petals numerous, broad, concave: stamens deep yellow. Hybrid, raised by Marliac; probably N. Mexicana × N. tuberosa (or alba). Strong grower, free bloomer; a general favorite. Flowered in this country in 1889.

Subgenus IV. Castalia.

A. *Rhizome erect: fls. pure white.*

32. **tetrágona**, Georg. (*N. pygmæa*, Ait.). Lvs. horseshoe shape, entire, the lobes diverging, slightly produced and subacute, dark green above, inclined to brown blotching, reddish beneath, 3 to 4 in. across: fls. 1½–2½ in. across, open on 3 or 4 days from noon until 5 P. M.; base of fl. square; petals 13–17; stamens about 40, yellow. E. Siberia, China and Japan; also in N. Idaho, U. S., and Ontario, Canada. B.M. 1525.—The smallest of the genus; free bloomer; makes no side shoots from the single crown, but grows readily from seed. Seed next to the largest of the genus.

33. **nítida**, Sims. Lvs. entire, suborbicular; lobes obtuse: fls. white, cup-shaped: tender. Described in B.M. 1359 without habitat, and never positively identified since.

AA. *Rhizome horizontal or, if not, fls. pink or red.*

B. *Lvs. scattered loosely on the rhizome.*

34. **odoràta**, Ait. Sweet-scented Water-lily. Lvs. nearly orbicular, entire, somewhat coriaceous, dark green above, purplish red when young; under surface deep red to reddish green or almost pure green; diam. 5–10 in.; lobes usually diverging, but often touching or slightly overlapping; petioles greenish or brownish: fls. (in the type) white, 3–5 in. across, open three days from 6 A. M. till 12 M.; sepals green, tinged with reddish brown; petals 23–32, ovate to lance-ovate; stamens 55–113, yellow; outer filaments broad, white, petaloid; seed medium sized. Eastern U. S., common. B. M. 819 (small).—Varies greatly in size and color, approaching *N. tuberosa*.

35. Var. **mlnor**, Sims (*N. Union*). Lvs. deep red beneath (or green when aërial): lobes diverging; diam. 2–5 in.; fls. white, 2¼–3¼ in. across; sepals strongly purple-colored; petals 17–24; stamens 37–78. Sometimes growing where water recedes entirely in summer; usually in shallow water. Same range as type; often a shy bloomer. B.M. 1652.

36. Var. **rósea**, Pursh (var. *rubra*). Cape Cod Water-lily or Pond-lily. Lvs. dark reddish on both sides when young, becoming green above: fls. pink, fading on the successive days of opening, 4 in. across. Southeastern Massachusetts. B.M. 6708 (too pale).

37. Var. **gigantèa**, Hort. RICE-FIELD WATER-LILY. Lvs. large, 12–16 in. across, green beneath, at times tinged purplish toward margin; edge often turned up; petioles green: fls. 4–7 in. across, pure white; sepals green; petals 24–31; stamens 69–120. Del. to Fla. and La. Approaches *N. tuberosa*.

GARDEN VARIETIES OF THE N. ODORATA TYPE.

38. *Carolinìana*, Hort. (var. Carolinensis = var. superba = N. tuberosa, var. superba). Lvs. entire, 12 in. across, sinus barely closed; green above, red beneath: fls. fragrant, 7 in. across; petals narrow, abundant (42?), delicate rosy pink; rhizome stout. A robust plant, raised by Dr. Bahnsen, Salem, N. C., about 1890. Probably N. odorata, var. rosea × N. tuberosa.—39. *Lucìana*, Hook. Like 38 in habit, etc., fls. rosy pink.—40. *exquisìta*, Marliac. Lvs. green above, intense red beneath: fls. large, rosy carmine, darkest of this group; very near to 36. Introduced about 1890.—41. *rosàcea*, Marliac. Fls. salmon pink, more delicate in tint than 36. Int. by Marliac in 1891.

42. **Parkerìana,** Lehm. Habit and foliage of 34: fls. large, pure white with bright yellow stamens and 16–20-rayed stigma; petals broader and shorter than 34. Guiana.

43. **tuberòsa,** Paine (*N. renifórmis*, Walt. (Gray) *N. blanda* of gardens?). Fig. 1501. Distinguished from No. 34 chiefly by the numerous slenderly attached and spontaneously separating tubers, 1–3 in. long on the rhizome. Lvs. when floating less coriaceous than in 34, and more veiny above; petioles marked with longitudinal brown stripes; no purple or red color about lvs. or sepals: fls. 4–9 in. across, pure white, open three or four days from 8 A. M. to 1 P. M.; petals broad, concave: seeds the largest of the genus. North central U. S. G. F. 1:366, 367; 6:416 (good). B.M. 6536 (poor). A luxuriant grower; when crowded or in shallow water the lvs. and fls. rise 4–6 in. above the water; spreads rapidly by tubers. Moderate bloomer.

1501.
Nymphæa tuberosa.
(×¾.) No. 43.

44. Var. **máxima** (*N. odorata*, var. *máxima* of gardens). A form with round lvs. and closed sinus, the lobes curved out at apex to a short point; petioles pubescent, with long hairs, with a few faint longitudinal brown stripes: fls. medium to large, pure white, somewhat cup-shaped. Lake Hopatkong, N. J. Rather smaller than the type! Possibly a natural hybrid of *N. tuberosa* and *odorata*.

GARDEN VARIETIES OF N. TUBEROSA.

45. *Richardsonii*, Tricker (=var. plena). Fls. very double, pure white, standing well above the water; sepals and outer petals drooping. Int. by Geo. Richardson of Lordstown, Ohio, about 1894.—46. *rósea*, Hort. Fls. pink, standing above the water. Probably N. tuberosa × N. odorata, var. rosea.

BB. *Lvs. crowded on the rhizome.*

47. **cándida**, Presl. (*N. biradiàta*, Sommerauer. *N. semiapérta*, Klinggraef). Similar to 48. Angles of attachment of sepals projecting; all the filaments broader than the anthers: fr. ovoid; seed large. Forms sterile hybrids with 48. Central and northern Europe.

48. **álba,** Linn. Lvs. roundish, entire, floating, 4–12 in. across, red when very young: rhizome black: fls. white (in the type), 4–5 in. across, open from 7 A. M. to 4 P. M.; petals broad, ovate, somewhat concave; angles of attachment of sepals rounded; filaments of inmost stamens not wider than the anthers: fr. more or less spherical; seed small. Eu., Siberia.—A robust species.

49. Var. **rósea,** Mast. (*N. alba*, var. *rùbra* = *N. alba*, var. *sphærocárpa* = *N. alba*, var. *Cásparii*). Outer petals rosy, intermediate ones intensely rosy, inmost petals with the filaments and processes of carpels deep red-brown: variable in purity of color. Fagertärn, Sweden; rare. B.M. 6736 (stamens poor). R.H. 1879:230.—Difficult to manage in this country.

50. Var. **Frœbelii,** Hort. A dark-fld. form of 49; also hard to succeed with in this country.

51. Var. **candidíssima,** Hort. (*N. candidíssima*, Hort.). Lvs. orbicular; lobes strongly curved, overlapping; yellowish when very young: rhizome brownish, sometimes 3 in. through: fls. large, pure white, sterile. The first to bloom in spring, continuing until frost; very robust. Most desirable white variety.

GARDEN VARIETIES AND HYBRIDS OF N. ALBA AND OF N. ALBA, VAR. ROSEA.

FIRST GROUP.

52. *Marliàcea*, var. *álbida*. Fl. large, dazzling white; petals narrow, numerous; stamens with a tendency to be flushed pink. Int. about 1889. Gn. 52:1147, p. 444.—53. *Gladstoniàna*, Tricker, is much like 52, larger and of more open growth. Int. by Geo. Richardson, Lordstown, Ohio, in 1898.

54. *Marliàcea*, var. *cárnea*, like 52 except in color, which is a soft flesh pink, deepening toward the base of the petals; fragrance of vanilla. Int. about 1889. 55. *Wm. Doogue*, like 54, but of more open growth: petals evenly colored, broader and more concave. Int. by Henry A. Dreer in 1899.

56. *Marliàcea*, var. *rosea*. Fls. large, deep rose color; young lvs. purplish red, changing to deep green. Int. about 1889.

SECOND GROUP.

57. *Láydekeri*, var. *rosea* (N. Laydekeri), with a thick erect rootstock, forming no offsets: fls. small, rosy pink, changing to purplish, opening about 11 A. M. Int. by Marliac about 1893; probably N. tetragona × N. alba, var. rosea.—58. *Láydekeri lilàcea* (N. liliacea = N. lilacina), color soft rosy lilac, with yellow stamens; odor of a tea rose: lvs. with occasional dark blotches. Int. in U. S. in 1895.

59. *Láydekeri*, var. *fulgens*. Petals concave, crimson pink; stamens dark red. Very brilliant. Int. in 1895.—60. *Láydekeri, purpùrata* (N. L. purpurea). Fl. rosy crimson; stamens orange red. Int. in 1895.

61. *lúcida*. Fls. large, rosy vermilion: lvs. blotched with reddish brown. Int. by Marliac in 1895.

62. *Róbinsoni* (N. Robinsoniana). Fls. large, floating; a yellow ground color, overlaid with purplish red: lvs. blotched. May be N. alba, var. rosea × N. Mexicana. Marliac hybrid, introduced into U. S. in 1895. Gn. 52:1147.

63. *fúlva* closely resembles 62: lvs. spotted brown above, red beneath. Int. by Marliac in 1895.

64. *Seignorèti*. Fls. delicate yellow shaded with rose and carmine; borne about 6 in. above the water: lvs. mottled. Probably N. alba, var. rosea × N. Mexicana. Int. by Marliac about 1897.

65. *Andreâna*. Outer petals dull, whitish at apex, red below; inner petals dull dark red; stamens bright orange; lvs. blotched; lobes overlapping. Shows blood of N. Mexicana. Int. by Marliac about 1897.

66. *Aurora*. Fls. rose-yellow on first day, becoming deep red on the third; general effect orange; sinus of leaf open. Int. by Marliac about 1897.

67. *Ellisiâna*. Fls. brilliant carmine purple. Int. about 1897. 68. *gloriôsa*. Very dark red; much like 67. Int. in 1899. 69. *James Gurney*. Fls. 5–6 in. across, dark rose color. 70. *Wm. Falconer*. Fls. 6–7 in. across, bright garnet color. (Nos. 69 and

1502. Nymphæa gracilis (× 1-12). No. 83.

70 resemble 67). Int. by Henry A. Dreer in 1899. 71. *Marliácea*, var. *flammea* (N. flammea). Very similar to 67. Int. in 1895. 72. *Marliácea*, var. *ignea* (N. ignea). Similar to 67. Int. in 1895. 73. *Marliacea*, var. *rubra-punctata*. Fls. deep rosy purple, spotted carmine. Int about 1897. 74. *Sanguinea*. Similar to 73. Int. by Marliac in 1898.

SECTION II. APOCARPOUS NYMPHÆAS.

Subgenus V. Brachyceras.

A. *Lvs. entire or slightly wavy at base.*

75. **élegans**, Hook. Lvs. narrowly peltate, orbicular to ovate, margin entire or with 5 or 6 small scattered teeth; under surface dark purple; diam. 7 in.: fls. pale violet, 3–6 in. across, open three days from 8 A. M. to 1 P. M.; buds ovate; sepals marked with black lines and dots; petals ovate, obtuse, 12–20; stamens stout, about 75, yellow; appendage a mere tip; filaments broad. Mex. B.M. 4604.

76. **cærùlea**, Savigny (*N. stellàta*, Caspary. *N. scutifòlia* of gardens). Blue Lotus of Egypt. Lvs. narrowly peltate, oval, entire or slightly sinuate at base; under surface green with dark purple blotches, purplish at margin, 12–16 in. across: fls. 3–6 in. across, open three days from 7:30 A. M. to 12 M.; buds conical; sepals thickly marked with black lines and dots; petals 14–20, lanceolate, acute, light blue above, lower half dull white; stamens 50–70; outer filaments broad, yellow; appendage long (three-sixteenths in. on outer stamens), pale blue. Egypt, northern and central Africa. Ann. Mus. Paris, vol. 1 (1802), p. 366 e.p. F.S. 7:653.—Free grower and bloomer but not showy.

77. **micrántha**, Guillemin & Perottet. Lvs. elliptic, entire in apical half, rest of margin sinuate; sinus deep; lobes spreading, much produced and acuminated, bearing bulbs which produce new plants at the top of the petiole! Under side of leaf green, tinged with purplish brown and minutely dotted: fls. small, white, 3–5 in. across; calyx pale green, unspotted; petals lanceolate and very acute. West coast of Africa. B.M. 4535.—Not yet introduced into America.

AA. *Lvs. distinctly or deeply sinuate.*

B. *Sepals spotted with blackish dots and lines.*

78. **pulchérrima**, Tricker. Lvs. somewhat peltate, orbicular-ovate, strongly sinuate, angle of lobes acuminate; under surface green, densely blotched with purplish black; margin purplish red; diam. 16 in.: fls. light blue, 10–12 in. across: buds sharply conical; petals 22, lance-ovate, whitish at base; stamens about 140, appendaged; filaments yellow, outer ones broad; appendage and back of outer anthers blue. Probably *N. Capensis* × *N. cærulea*. Raised by W. Tricker.

79. **stellàta**, Willd. (including *N. versicolor*, Roxbg. B.M. 1189). Blue Lotus of India. Lvs. elliptic-orbiculate, rather broadly peltate; margin irregularly repand-dentate; lobes hardly produced; green above; deep blue-violet beneath: fl. 3–7 in. across, pale blue (rarely pink or white), open three days from 8 A. M. to 2 P. M.; buds ovate; sepals with minute blackish dots; petals 11–14, dull white at base; stamens 33–54; appendage blue; anthers and filaments pale yellowish. Southern and eastern Asia. Andrews Bot. Rep. 5:330. B.M. 2058.

80. **ámpla**, DC. (not of gardens). Lvs. narrowly peltate, sub-orbicular, sinuate or nearly entire, with small black spots above and below, 6–15 in. across: fls. white, diam. 3–8 in.; sepals coriaceous, ovate-lanceolate, acute; petals 7–21, lance-ovate; stamens 30–190, outmost ones much longer than inmost. Texas, south to the West Indies and Brazil. Fl. Brasil, 77. p. 129 pl. 28–30. B.M. 4469.—Very near of kin to *N. gracilis*.

BB. *Sepals without blackish markings.*

81. **Capénsis**, Thunb. (*N. scutifòlia*, DC. *N. cærulea* B.M. 552 and American gardens). Cape Blue Water-lily. Lvs. rather narrowly peltate, orbicular-ovate, strongly sinuate-dentate, angle of lobes produced, acuminate; 12–16 in. across: fls. rich sky-blue, 6–8 in. across: open four days from 7 A. M. to 4 P. M.; buds ovate; sepals pure green outside, whitish within; petals 20–30, lower third nearly white, narrowly elliptic; stamens about 150 (97–221, Casp.); filaments yellow, outmost ones broad, inmost filiform; appendage and back of outer anthers blue. S. Africa. Andr. Bot. Rep. pl. 197. F.S. 6:645.—A very desirable species. 82. Var. **Eastoniénsis**, Ames (*N. stellàta*, var. *Eastoniénsis*). Fls. steel-blue; petals broader and more rounded than in the type, rather larger: lvs. longer, oval, more deeply toothed. Seedling from the type, raised by C. Blomberg, gardener to O. Ames, N. Easton, Mass., in 1896. G.F. 9:475.

83. **grácilis**, Zucc. Fig. 1502. Lvs. narrowly peltate, deeply and irregularly sinuate or nearly entire, suborbicular; angle of lobes rounded; under surface pure green (or suffused purple in hybrids), 15–17 in. across; fls. white, 6–8 in. across; sepals pure green; petals 16–20, acuminate; stamens about 60, deep yellow; outmost filaments short, broad, petaloid; anthers with long yellowish appendage. Mexico.

1503. Nyssa sylvatica (× ¼).

Garden forms of *N. gracilis*: 84. *Wm. Stone* (and var. cærulea). Habit and form of 83: fls. large, open from early morning till evening; sepals green outside, blue within; petals dark blue, with a purplish cast; stamens very numerous. Doubtless a hybrid of N. grácilis and N. Zanzibariensis. Raised by W. Tricker, Riverton, N. J., 1899.—85. *Mrs. C. W. Ward*, like 84, except in color, which is a beautiful pink. A charming variety, exhibited by W. Tricker, in 1900.—86. *Mauvii*, "fls. delicate pale mauve, sweet scented;" seedling raised by S. Henshaw, at W. Brighton, N. Y., about 1892.—87. *Grèyæ*, a form of 83, raised by Benj. Grey, Malden, Mass., with blue fls. shading to white.

88. *Capensis* × *Zanzibariensis*. Lvs. somewhat peltate, orbicular-ovate, strongly sinuate, angle of lobes acuminate; under surface dark purple: 8–16 in. across. fls. rich blue, open 3–5 days, from 9 A. M. to 4 or 5 P. M., 6–8 in. across: sepals green outside, blue within; petals 15–20, narrow, acute; stamens 60–100: appendage blue. Cult. about Phila. Free bloomer, strong grower.

89. **Zanzibariénsis,** Casp. Lvs. somewhat peltate, orbicular or orbicular-ovate, margin closely sinuate-dentate; angle of lobes hardly pointed, under surface more or less suffused violet; diam. 8–15 in.: fls. 6–12 in. across, open three to five days from 11 A. M. to 5 P. M.; sepals green outside, margins purple, deep purplish blue within; petals 18–24, oblong, obtuse, deep blue; stamens 136–242, appendage dark blue; back of anther dark crimson-violet; outer filaments obovate, yellow. Zanzibar, B.M. 6843 (as *N. stellata*, var. *Zanzibariensis*). Gn. 25:431 (small). 90. Var. **azúrea,** light blue, and 91, var. **rósea,** pink, are otherwise like the type, but open earlier in the morning; they come up promiscuously from seed of the type or of one another.

92. **Astræa,** Grey (*N. grácilis* × *N. Zanzibariénsis*). Leaves floating, with general habit of a strong-growing *N. gracilis*, green, tinged purple beneath. Fls. standing well above water, stellate, with a resemblance to *N. gracilis*, but much larger; sepals green, shading to yellow at base, the inner surface bright blue, shading through white to translucent at the base; petals blue, shading to white at base, usually about 17 in number; stamens less than 70, linear-lanceolate, yellow, tipped with blue-purple; stigma less than 20-celled, with blunt-toothed, yellow apices. Both parents hybridize freely either way, but the hybrid is sterile. Unites the American (Mexican) with the African species. Var. **rósea,** Grey, is like the preceding, but the color is rose-pink instead of blue; it is hybridized with *N. Zanzibariensis rosea* instead of the type.

Subgenus VI. Anecphya.

93. **gigantèa,** Hook. Lvs. narrowly peltate, elliptic or ovate, margin sinuate-dentate, sinus open; under surface brownish pink, becoming purple; 18 in. across: fls. light blue to violet (rarely rose color or white), open seven days from 9 A. M. to 6 P. M.; diam. 6–12 in.; sepals pure green; petals very many, dark blue at tip, shading to nearly white at base; stamens 680–745; filaments mostly filiform; anthers bright yellow. Australia. B.M. 4647. F.S. 7:751.—The most delicate and lovely, and withal one of the largest of the genus.

Henry S. Conard.

NÝSSA (name of a water nymph; these trees grow in swamps). *Cornàceæ*. Tupelo. Pepperidge. Sour Gum. Tupelos are bold and picturesque, hardy deciduous trees, valued for the flaming scarlet of their autumn foliage and for the distinctness of their winter aspect. They grow in swamps and are usually 40–60 feet high, attaining a maximum of 100 feet. Old specimens often have a melancholy appearance by reason of the drooping habit of the lower limbs. The upper branches of a Tupelo are often twiggy, crooked or "kinky." The foliage is leathery, and as glossy as if varnished. Tupelos are hard to transplant from the wild, even when heavily pruned, because they have remarkably long roots with few rootlets. Nursery-grown trees that have been frequently transplanted are preferable, but seedlings are easily raised. Of the 7 species, 2 are natives of eastern Asia, the rest of North America. The only species offered by American nurserymen is *N. sylvatica*.

Nyssas are trees or shrubs with petiolate, usually entire lvs. and small fls. borne in short racemes or dense

1504. Pepperidge—Nyssa sylvatica.

heads. Unlike the Dogwoods (Cornus), they belong to a group in which the fls. are unisexual, instead of hermaphrodite. From Aucuba and Garrya they differ in having alternate lvs. Nyssa is distinguished from its immediate allies by the following characters: petals of the male fls. none, or 4 to many, imbricated; stamens 4 to many: ovary 1-celled; style 1, simple or 2-parted.

sylvática, Marsh. (*N. multiflòra*, Wang.). Tupelo. Pepperidge. Black Gum. Sour Gum. Figs. 1503–4. Lvs. usually entire, obovate or oval, mostly acute or acuminate, 2–4 in. long: staminate fls. in compound heads; pistillates larger, 2–14 together: fr. 3–7 lines long, nearly black, acid, with an ovoid stone, little flattened. Me. and Ont. to Mich., to Fla. and Tex. G.F. 3:491; 7:275. B.B. 2:547.

W. M.

O

OAK. Plate XXI. Strength, solidity, durability are symbolized in the Oak. The tree is connected with the traditions of the race, and it is associated with literature. It is a tree of strong individuality, with bold, free growth and massive framework. Its longevity appeals to every person, even though he has no feeling for trees. It connects the present with the past. It spans the centuries.

This feeling that the Oak represents a long span of years is itself the reason why we should consider the tree with veneration and let it live its full time; and this is the particular lesson which the writer would impress. Spare the isolated Oak trees! Of whatever kind or species, a mature Oak is beyond price. To allow it to remain bespeaks culture and kindly feeling.

1505. Variable foliage of the Oak.—Pin Oak type.

Many species of Oak are now available in nurseries. There are perhaps 25 species that can be relied on for planting in the northeastern states, and there are particular varieties adapted to almost every habitable part of North America. The planting of cheap, quick-growing willows and poplars is so common that one almost despairs of the time when such strong and expressive trees as Oaks shall be planted. There is little difficulty in the planting of Oaks if one secures nursery-grown stock. They grow more slowly than some other trees, but what they lack in rapidity of growth they make up in character and foliage color. If quick effects are wanted, some fast-growing tree may be planted with them, to be removed as the Oaks need the space. Some of the species grow nearly or quite as rapidly as hard maples, when young. Other species are mere bushes and make an excellent border-mass on the farther side of large grounds. Of such is the native Scrub-Oak (*Quercus ilicifolia*) of the eastern states. The native species are usually the best for any region, from the fact that they are adapted to climate and soil; and then, a feeling for common native plants is an indication of the highest appreciation and of the keenest response to the conditions in which one lives.

For a full sketch of the kinds of Oaks, see *Quercus*.

L. H. B.

Among the native deciduous trees of the eastern United States no kinds are more useful or attractive, either in economic value or for ornamental planting, than the various species of Oaks. Hardiness, longevity, beauty of foliage and fruit, exemption from the injurious attacks of disease or insect pests, and beauty, strength and durability of the lumber are among their especially valuable characteristics. The family of Oaks is a large one, but they mix and vary so much by natural hybridization and geographical variations that their botany is puzzling to all but the most astute scientific students. Casual observers and amateur botanists who attempt their study find them an interesting but difficult family to identify. A sprig from a tree which is probably a hybrid between the willow and Pin Oaks, Fig. 1505, is a fair sample of the kind of variations which are frequent in Oak forests. Experienced woodsmen, who are quite familiar with all the Oaks in their neighborhood, find that, a few miles from home, on different soil and elevation, they meet with varietal differences of bark, foliage, fruit and general appearance of trees which they can scarcely associate with the species as they have known them.

That Oaks have been esteemed and admired from time immemorial is evidenced by the numerous forms in which their leaves and fruit appear in all kinds of ornamentations in all ages.

Acorns of all species are objects of interest, but the larger forms, especially those of the Fringed or Mossy-cup Oak, are particularly attractive.

In autumn the foliage of Oaks remains green until many other trees have shed their leaves; then they assume rich shades of red, bronze and brown, presenting a splendor of ripening foliage less brilliant but not less beautiful than that which, a few weeks before, arrayed some of their forest companions so gorgeously.

It has been said that "Who plants Oaks, plants for posterity." Too often this has been interpreted to mean that Oak trees grow and develop so slowly that a planter may not reasonably expect to realize much benefit from his own plantings, but that long after he has passed away posterity will reap the harvest which he has sown. Judged from a lumberman's standpoint, this is nearly correct. The Pin Oak and some other species are mature at from 75 to 80 years of age, and seldom live more than 100 years, but the White Oaks are not fit for sawing into lumber until they have passed 125 years of age, and most of the large valuable trees are much older than this.

The White Oak, found naturally on low lands and clay soil, is unquestionably the patriarchal aristocrat among native trees of the eastern U. S. While it is a sorrowful fact that nearly all the tall forest Oaks with large trunks have fallen before the march of human progress, still there are a few venerable specimens left, with very large, spreading heads, but whose trunks are so short as to have little commercial value. These have undoubtedly stood for several centuries, and are still in unimpaired strength and vigor, being typical specimens of the natural development of their species when allowed time and room for growth in open clearings. One notable example is a White Oak in the Friends' graveyard in the city of Salem, N. J. Its trunk is 19 ft. in circumference 3 ft. from the ground, and its branches cover an area 118 ft. in diameter north and south, and 105 ft. east and west. Another specimen in North Mt. Moriah Cemetery, in Delaware county, Pa., in the suburbs of Philadelphia, measures 28 ft. 4 in. in circumference of trunk a foot above ground, and 22 ft. 4 in. at 3 ft. above ground, the branches spreading 96 and 106 ft. in diameter.

A few years ago one such white Oak was ruthlessly destroyed near South Glastonbury, Conn., by its vandal owner for the value of the fire-wood it contained. These trees were no doubt well established in the soil before Christopher Columbus discovered America. Such specimens are now so scarce it is a pity that they cannot be protected by law, and unappreciative owners be taught to regard such venerable trees for the pleasure which their presence affords to an intelligent public, if from no other motive. A fine old pasture Oak is shown in Fig. 1506.

1506. Field-grown white Oak.

Considered from a gardener's or planter's standpoint, the Oaks are among the most valuable of our native trees. An idea that they are very difficult to transplant and slow of growth, for many years almost barred them from cultivation, but experiments made within the past 20 years have done much to correct this popu-

lar prejudice, and have shown that by using good trees and by giving proper subsequent care and attention, Oaks will grow as easily and develop as rapidly as many other species, and are very satisfactory. A Pin Oak in the grounds of the writer, about 65 years old, is more than 70 ft. in height, 60 ft. in spread of branches, and 11 ft. in circumference of trunk 3 ft. from the ground. A Swamp White Oak in the same lawn is about 50 years old, and is 50 ft. in height, 54 ft. in spread of branches and 7 ft. in circumference of trunk 3 ft. from gronnd. These trees are growing on a rich, sandy loam, which is well drained by a substratum of gravel and sand.

A notable object lesson in the use of Oaks in ornamental planting is found in Fairmount Park, Philadelphia, Pa. After the close of the Centennial Exhibition which was held there in 1876, the buildings were removed, the gronnds cleared, and from 1880 to 1884 thousands of Oaks were planted in this section; a majority of them Pin Oaks, but interspersed with them White, Swamp White, Red, Scarlet, Black, Chestnut, Willow, Bur, Shingle, etc., as well as maples, ash, lindens, elms, poplars, buttonwoods and some others. These Oaks are now from 20 to 40 ft. high, and from 2½ to 3½ ft. in circumference measured at 3 ft. above the gronnd, and are equal or superior in size and development to most of the other trees, which were planted at the same time, excepting Carolina poplar and buttonwood. These trees are on level land and in heavy clay soil, which appears to be a favorite condition for most of the larger growing species of Oaks. Fig. 1507 may suggest an idea of the remarkable progress and development which these trees have made in from 16 to 20 years. There are few trees even among those which are considered fast-growing varieties that will show better measurements or more symmetrical developments at the same age.

If seedling Oaks are taken up when one or at most two years old, transplanted every three years, and well cultivated on good land, they will form fine trees, with root systems which can be moved with but little risk until they attain considerable size, but unless they have had such culture, the transplanting of any but very small trees is usually unsatisfactory. Attempts at moving trees which have stood too long without trans planting or which have grown without cultivation have generally resulted in failure, and such experiences have caused the prejudice which has prevented their more general use. Under favorable circumstances most Oaks are rapid growers, but unless conditions are favorable their roots do not become readily reëstablished in the soil after transplanting, and for this reason they are often slow to start into vigorous growth. For this reason judicious nursing, with plenty of manure and water and cultivation of the soil, will be abundantly rewarded by shortening the period of convalescence.

While many soft-wooded trees transplant more readily than Oaks and will grow more rapidly immediately after transplanting, still the Oaks will in time outgrow most of them, and will be in their prime when many of the companions of their youth are declining or gone. The best Oaks for planting in the northeastern and middle section of the U. S. are White, Swamp White, Mossy-cup, Scarlet, Pin, Red, Willow, Laurel or Shingle and Chestnut. Of these the Pin is at present the most popnlar, because it develops quickly a thick, compact head, forming a beautiful symmetrical tree while quite young; but after it is 25 or 30 years old the interior branches of this dense head begin to die and a tangled mass of dead brush soon accumulates. Unless this is removed (and it is not an easy task), it gives the tree a neglected and unsightly appearance. Other species of this type have this tendency also. The White and Chestnut Oaks and their allies have more spreading branches, are more open-headed, and are not subject to this objectionable characteristic, but they continue to increase in size, with unimpaired beauty and symmetry of form, for centuries.

Plate XXI shows a group of Oaks familiar to many who have traveled between Philadelphia and New York via the Pennsylvania railroad. The trees stand about 100 yards north of the railroad track in a field a quarter of a mile east of a small station called Andalusia, 7 miles west of Bristol. The large tree is a White Oak, measuring 15 ft. in circumference 3 ft. from the ground, with branches spreading 78 ft. in diameter. It is a typical specimen of the habit of this tree as it grows in open land. The middle tree is a Pin Oak probably 50 or 60 years old. It has several dead branches and is evidently declining. The next tree is a Willow Oak. They stand in heavy clay soil on rather low land, but not swampy. There are numerous fine specimens of Oaks in this locality, which for many years have attracted the attention of travelers. The Black Jack and Scrub Oaks, which as bushes and small trees cover large areas of the sandy belt stretching along the Atlantic coast from Long Island to Florida, and the Rock

1507. Avenue of Pin Oaks.
Fairmount Park, Philadelphia, planted about 1884.

Chestnut and other species, which find subsistence on the steep and rocky hill-sides of the eastern states, do not often attain large size. Nevertheless their presence is of great economic value in covering barren wastes with vegetation, where few other trees can find enough to support life. In many other situations these dwarf Oaks are admirably adapted for producing desirable effects.

The "grand old Oaks of England" have been admired and venerated for centuries, but in this country the American Oaks are far superior to any of the European species, as they develop faster and are more enduring. *Quercus Robur*, which is the European species most commonly planted in this country, appears to be short-lived here, usually declining before it reaches 50 years of age.

Everywhere in the southern states the Live-Oak is popular (Fig. 1508). It is associated with every old plantation. It is the characteristic tree of the country from the Carolinas south and west.

Samuel C. Moon.

OAKÈSIA (Wm. Oakes, New England botanist). *Liliàceæ*. A genus of 2 species of American hardy perennial herbs, having the graceful habit of such choice wild flowers as the Solomon's Seal and more particularly the common bell-wort, *Uvularia perfoliata*. In moist woods it grows about a foot high and bears one or few pendulous, yellow, 6-parted fls. about ½ in. long. The 2 kinds can be transferred from the woods. *O. sessilifolia* is also offered by a few dealers in hardy plants. It prefers a rich light soil in a rather moist, partially shaded position, and improves greatly under cultivation.

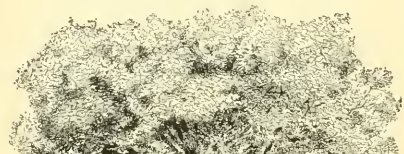
The Oakesias can be easily told from Uvularias by their leaves, which are merely sessile instead of perfoliate, i. e., the base of the leaf does not surround the stem as it does in Uvularia. Oakesias were formerly placed in Uvularia, but in 1879 Watson removed them, largely because of the seeds, which are brown and nearly spherical in both groups, but in Oakesia they have a very much swollen, spongy, brown ridge, while in Uvularia they are covered by a thin white aril (an appendage growing from near the point where the seed is attached to the ovary). Other generic characters are: fls. few, solitary on short pedicels opposite the lvs.; segments without callosities: capsule membranous, elliptical, acutish at each end, very tardily dehiscent: lvs. more or less rough on the margins.

sessilifòlia, Wats. Stem once forked: lvs. oblong-lanceolate, acute at each end; margins minutely scabrous: capsule borne on a distinct stipe. Canada to Fla. and Ark. B.M. 1402. L.B.C. 13:1262. G.W.F. 16. D. 51.

F. W. BARCLAY and W. M.

OAT. *Avena sativa.*

OBELISCÀRIA. See *Lepachys.*



1508. The wide-spreading Live Oak of the South.
(See Oak, page 1111.)

ÓCHNA (old Greek name for a wild pear, which some of these plants were thought to resemble in foliage). *Ochnàceæ. O. multiflora* is a cool greenhouse shrub cult. by a few fanciers for its remarkable appearance when in fruit. The fls. are yellow, appear in spring, and are borne to the number of 10–15 in racemes terminating short lateral branches. The blossoms are short-lived, but the calyx is persistent. Its 5 sepals are greenish in flower, but become a bright red in fruit. The receptacle increases until it becomes an inch or so thick, globular and bright red. Upon it are borne black seed-like bodies, which are the carpels. The red and black make a fine contrast. This rare plant is best prop. by cuttings struck in autumn. It is cult. in America, but not advertised.

Ochna is a genus of about 25 species of trees and shrubs from tropical Asia and Africa: lvs. deciduous, alternate, minutely serrate, leathery, shining: fls. yellow, rarely greenish, jointed to the pedicels; sepals 5, colored, imbricate, persistent; petals 5–10; stamens indefinite; anthers opening longitudinally or by pore-like slits; ovary deeply 3–10-lobed; lobes 1-celled, 1-ovuled; styles connate; drupes 3–10, sessile.

multiflòra, DC. Glabrous shrub, 4–5 ft. high: lvs. oblong-elliptical to oblanceolate-oblong: petals sessile: anthers as long as the filaments, opening longitudinally: sepals in fruit about 4 lines long. Upper Guinea.

G. W. OLIVER and W. M.

Ochna multiflora is a remarkably handsome shrub for conservatory decoration. It is usually regarded as a stove shrub, but has done well with us in a greenhouse temperature of 55° (min.). It has a unique effect, and to be properly appreciated specimens should stand out. The drupelets are black, making a striking contrast with the enlarged red receptacle, at a glance reminding one of a spindle tree. In a good bottom heat, seeds germinate in a month, and make neat little plants in a year. We have not been so fortunate with cuttings. Unfortunately for us, cat-birds appropriated all the berries as soon as they became ripe. They entered through the open spaces in the annex to our conservatory.

T. D. HATFIELD.

ÓCIMUM. See *Basil.*

OCOTILLO. *Fouquieria splendens.*

ODONTADÈNIA (Greek, *toothed glands*). *Apocynàceæ.* Here belongs the fine tropical yellow-fld. climber sold as *Dipladenia Harrisii*, which rivals in beauty the well known greenhouse Allamandas. The fls. are fragrant, about 3 in. across, funnel-shaped, with 5 rounded, spreading lobes, and are more or less streaked with red in the throat, at the base of the lobes, and on the back of the tube. The treatment which George McWilliam has given Dipladenias with such good results (see *Dipladenia*, Vol. 1) should be attempted for Odontadenia, but *O. speciosa* perhaps grows at lower altitudes, and may require the treatment usually given to hothouse vines. All Odontadenias have yellow fls., while Dipladenias are yellow only in the throat.

Odontadenia is a genus of about 8 species of tall, shrubby, tropical American climbers: lvs. opposite: cymes loose, usually ample, rarely few-fld. and scarcely branched: calyx 5-parted, the lobes remarkably blunt or rounded; corolla-lobes twisted in the pointed bud, overlapping to the right and twisted to the left; stamens fixed at the top of the narrow part of the tube. The genus is distinguished from Dipladenia by the shape of the calyx-lobes and by the cup-shaped group of toothed glands below the pistil.

speciòsa, Benth. (*Dipladènia Hárrisii*, Hook.). Shrubby, branched climber: largest lvs. 10–15 by 4–5 in., oblong, tapering, scarcely leathery, feather-veined, often purplish beneath; petioles stout, scarcely 1 in. long: racemes axillary and terminal; pedicels red, often 1 in. long, curved downwards: corolla-tube with a roundish base about ½ in. long and thick, then suddenly constricted, then gradually widening into a funnel-shaped fl. Brazil, Guiana, Trinidad. B.M. 4825.

W. M.

ODONTOGLÓSSUM (Greek, *tooth-tongue;* in allusion to the crest on the labellum). *Orchidàceæ.* A genus of orchids embracing about 100 species, natives of the higher regions of the Andes from Mexico and Guatemala to Colombia and Bolivia. On account of their handsome flowers these plants are among the most favorite orchids of cultivators. *O. crispum* is one of the finest of all orchids.

Plants epiphytic, with short rhizomes and 2-lvd. pseudobulbs, often with sheathing leaves at the base: fls. in few- to many-fld. racemes or panicles arising from the base of the pseudobulb; sepals and petals spreading, free, or the lateral sepals rarely somewhat united at the base; base of the labellum ascending parallel to the column and sometimes adnate to the latter; lateral lobes small, often erect; middle lobe large, spreading, variously shaped; column clavate, narrowed at the base, longer than in Oncidium.

This genus is closely related to Oncidium and Miltonia, some of the species of the latter being generally cultivated as Odontoglossums. These two genera are easily distinguished from Odontoglossum by the labellum, which expands directly from the base of the column. There is perhaps no genus of orchids in which the species are more variable and more closely related than in Odontoglossum. Numerous varieties connect the species by intermediate links, and the occurrence of many natural hybrids makes the limitation of species in this genus almost impossible. However much this may add to the perplexity of the botanist, it gives the genus an additional horticultural value and interest resulting in the production of numerous garden hybrids and in the selection of many varieties, one species, *O. crispum*, having over a hundred named kinds.

HEINRICH HASSELBRING.

Odontoglossums follow the high western mountain ranges from southern Mexico to southern Peru, and usually grow at great altitudes. With few exceptions, they are found in extremely moist situations where the annual rainfall is excessive and the temperature more or less even and cool throughout the year.

The extreme heat of our summer interferes somewhat with the culture of Odontoglossums in America, especially those of the *O. crispum* section, and it is necessary to use every precaution during that season to insure success.

A lean-to or half-span roof structure of northern exposure, protected by a brick or stone wall on the south side, and with ample means of ventilation, is best suited to Odontoglossum culture. Moreover, it should be provided with rolling shades elevated on framework 18 or 20 in. above the glass, to afford abundance of light, free access of air and requisite shade, with the additional assistance of keeping down the temperature in summer. The interior is best fitted with solid beds, if possible, but benches of stone flags or wood covered with ashes or gravel an inch or two deep will answer very well.

Odontoglossum crispum. Spray of Asparagus Sprengeri in the background

These, with the floors, should be hosed down two or three times daily, to keep the house as cool and as moist as possible.

Ventilation is highly essential at all times, especially in dull or wet weather. When the atmosphere is overcharged with moisture, the quantity must be governed by outside conditions. Top ventilation is most satisfactory, because it allows the heated air to escape, gives less direct draft on the plants, and does not have the drying effect produced by side currents.

The temperature during winter should never rise above 65° F., even with mild sun heat, and may fall to 48° or 50° at night, or even lower, without injury; during summer it must be kept as low as the outside temperature will admit. Fire heat should be dispensed with as early as possible in spring.

Odontoglossums do well under pot culture, excepting a few, such as *O. Londesboroughianum* and *O. coronarium*, with long creeping rhizomes; *O. citrosmum*, which has pendulous flower-scapes, and some of the smaller growing species, such as the *O. Rossi* section, which are more easily cared for under basket culture.

Repotting should be attended to in October and November, never during the summer months. Chopped fibrous peat, live sphagnum and clean decayed leaves in equal quantity, well mixed together, afford a very satisfactory compost. About one-half of the pot space should be devoted to drainage of charcoal or broken potsherds. The plants should be firmly potted, leaving the surface slightly convex, thus elevating the base of the plant a little above the rim of the pot when finished.

The *O. crispum* section, which includes *O. Coradinei*, *O. gloriosum*, *O. cirrhosum*, *O. luteo-purpureum*, *O. Pescatorei*, and kindred species, require an abundance of water at all seasons; in fact, the compost should never dry out, and judicious light overhead syringing once a day is beneficial in bright weather, but on very warm days it should be applied in the evening, at the same time allowing free ventilation to ensure good atmospheric action. Weak liquid cow manure during the flowering period is also of assistance.

Species of the *O. grande* section do not require as much water at the roots as the *O. crispum* type; the compost should be allowed to dry out frequently. They are also benefited by a little sun during winter.

O. citrosmum is an exception to the genus as regards temperature, and should be grown 10° warmer. It does very well in the Cattleya department, enjoys a good supply of water at the roots at all seasons, and may be easily induced to flower freely by giving it a sunny location during winter.

Very few of the species can be satisfactorily propagated by division; the trade depends principally on fresh importation.

Among the worst enemies of Odontoglossums are slugs and the small shell snails. They destroy the tender flower-scapes, often attacking them even in the leaf sheath. A piece of cotton wrapped about the base of the pseudobulb will afford a means of protection, and many may be caught by distributing bits of apple, potato, or saucers containing dry bran freely among the plants. Look them over morning and evening with a lantern.

For other cultural notes on Odontoglossums, see Orch. Rev. 4:22. ROBERT M. GREY.

Cool Odontoglossums.—The management of the tropical Odontoglossums found in high altitudes is one of the most difficult and fascinating problems in orchid culture. Nearly all American collections of them have decreased and have had to be refreshed from the tropics. The collection of H. H. Hunnewell, at Wellesley, Mass., has long been noted, although it has decreased in the last twelve years. The undersigned has been asked to give an account of the methods by which F. L. Harris long maintained this fine collection with perhaps less decrease than in any other collection in the country.

The great problem, of course, with these plants is to keep them cool enough in summer. The difficulty will probably never be wholly solved until the advent of artificial refrigeration. Shading alone is insufficient. The best principle to take advantage of is the coolness produced by the rapid and excessive evaporation of water. An example is the wet rag wrapped around a canteen in a hot desert, which keeps the drinking water cool.

How to produce a great and constant evaporation is, then, the particular problem, and Mr. Harris' device was an exceedingly ingenious one. Back of his Odontoglossum house he had a brick wall covered with English ivy, and he had water dripping over the whole vine during hot weather. This gave him an extraordinarily large evaporating surface.

In general, it may be pointed out that the conventional water pan gives a relatively small evaporating surface. A gravel bed yields a far greater evaporating surface. As an illustration, the undersigned would cite his own experience at the Buffalo Botanic Garden. There was a house built for *Victoria regia* and other tender aquatics, which was unoccupied during winter. An attempt was made to utilize this space in growing palms. The water tank was boarded over for the palms, but the water below did not furnish enough atmospheric moisture for the palms, and they had to be removed. The trouble was that the water in the big tank, being colder than the air, actually acted as a condenser. The next winter the tank was again boarded over, but the water in the tank was drawn off and the floor covered with a 6-inch layer of gravel. The results were entirely satisfactory.

J. F. COWELL.

With Odontoglossums we have had good results the past season by using what we call the Cookson formula, recommended by Mr. Norman C. Cookson in the "Orchid Review" for May, 1899. The formula is as follows: Three ounces of potassium nitrate and 2 ounces of ammonium phosphate, dissolved in a 3-gallon jar of soft water. In watering any orchids when making their growth, or when flowering, 1 ounce of the solution is added to each gallon of water used. In the experience of the writer, the above mixture is the best food met with for cool orchids. In time it will probably bring the plants into such a vigorous state that they will be able to stand our hot summers without so much suffering.

A. J. NEWELL.

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SECTION 1.

A. *Labellum reniform, larger than the rest of the flower*..... 1. **Londesboroughianum**

A. *Labellum oblong or fan-shaped, shorter than the sepals: apex rounded, emarginate, or acute: margin entire.*

B. *Apex rounded or emarginate.*

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CC. *Sepals oblong to lanceolate.*

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4. **Schlieperianum**

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7. **Lindleyanum**

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9. **facetum**

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11. **maculatum**

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B *Column with rhomboid wings*.....12. **mirandum**

BB. *Column with 2 subulate awns at apex*.....13. **gloriosum**
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1. **Londesboroughiànum,** Reichb. f. Pseudobulbs roundish ovate, 1–2-lvd.: raceme 3–6 ft. long, bearing as many as 30 fls.: sepals oblong, undulate, apiculate; petals obtuse, apiculate, wider; both light yellow, with many abrupt, narrow, concentric brown markings: blade of the labellum extending beyond the sepals, over 1 in. across, light yellow, with few brown blotches at base. Autumn. Mex. I.H. 30:497. Gn. 16, p. 502. F.M. 1877:246.—A distinct plant resembling an Oncidium. Var. **pardìnum,** Hort. Lip profusely dotted with brownish crimson. Gn. 16, p. 503.

2. **brevifòlium,** Lindl. (*O. coronàrium,* Hort.). Plants with leathery, ovate-oblong, spreading lvs. and erect racemes, about 1 ft. high, bearing 10–20 fls. 2–2½ in. in diameter: sepals subrotund-unguiculate, undulate: petals similar, smaller; labellum smaller than the sepals, cuneate-emarginate, yellow in front, marked about the column with yellow and purple, with a 3-toothed tubercle on the base. Colombia. I.H. 21:170. G.C. II. 24:177; III. 18:489; 19:79. G.M. 34:819; 38:127.

3. **grànde,** Lindl. Baby Orchid. Fig. 1509. Pseudobulbs 2-lvd.: lvs. broadly lanceolate: scape few-fld., twice as long as the lvs.: sepals lanceolate, the lateral ones keeled, yellow, banded with rich reddish brown spots; petals oblong, broader, obtuse, subundulate, apex yellow; labellum almost rotund, apex slightly emarginate, yellow, banded and spotted with rusty blotches, and with a large-lobed tubercle on the claw. Autumn. Guatemala. B.M. 3955. F.S. 1:24–26. P.M. 8:49. Gn. 48, p. 219; 51:1105. G.C. III. 17:41 (abnormal fls.). —A magnificent species with half-drooping racemes a foot long, bearing few large, brilliantly colored fls. 5–6 in. in diameter. Fig. 1509 is redrawn from "The Garden."

4. **Schlieperiànum,** Reichb. f. (*O. Insleayi,* var. *macránthum,* Lindl.). Fls. on erect racemes, pale yellow, blotched and barred with deeper yellow mostly on the lower half of the segments. Autumn. Costa Rica. G.C. 1865:1082; II. 25:269. F.S. 17, p. 78.—Resembles a small pale *O. grande,* but fine for summer flowering.

5. **Insleayi,** Lindl. (*Oncídium Insleayi,* Barker). Lvs. leathery, oblong, shorter than the raceme: fls. 3½–4 in. across, yellow, spotted with brown, borne in a stiff, erect raceme; sepals and petals oblong, undulate, nearly equal; labellum shorter, ovate, retuse, sagittate and tuberculate at base, orange-yellow, spotted with reddish brown. Oct.–Dec. Mex. F.S. 1:49. Gt. 39, p. 474.—Free-flowering. Resembles *O. grande.* Var. **splèndens,** Reichb. f. Fls. larger, labellum and segments clouded with brown, yellow only at the tip. Gn. 25:428. G.C. II. 25:305. Var. **leopardìnum,** Hort. A highly colored form. Segments pale yellow, heavily barred with chestnut-brown. R.B. 14:61.

6. **Coradìnei,** Reichb. f. (*O. Lindleyanum,* Reichb. f. and Warsz. × *O. crispum,* Lindl.). A supposed natural hybrid with the habit of *O. crispum.* Raceme arching, few-fld.: fls. stellate, 3 in. across, dark sulfur color, with few chestnut-brown spots; sepals and petals oblong, acuminate, undulate; labellum shorter, oblong-acute, whitish, with a large oblong red-brown blotch near the center and several smaller ones on the disk; crest 3-toothed on each side. Resembles *O. triumphans,* but of more slender growth. Winter. Colombia. G.C. 1872:1068; II. 24:200; 25:269; III. 25:315.—Var. **supérbum,** Hort. A more robust var. with richly colored fls.: panicle much branched, 2 ft. long. Mexico. Var. **grandiflòrum,** Reichb. f. Fls. yellow, blotched and spotted with dark brown, large and handsome. Colombia.

7. **Lindleyànum,** Reichb. f. and Warsz. Lvs. linear: raceme lax: fls. 2–3 in. across, thin; sepals and petals yellow, blotched and striped with brown; lateral lobes of the labellum small, white, with purple spots; middle lobe red-brown, tipped with yellow. Spring. Colombia. —A variable species, supposed to be the parent of many hybrids.

8. **luteo-purpùreum,** Lindl. Lvs. ensiform, narrowed at base: fls. showy, 2–3 in. across, in a robust horizontal raceme; sepals ovate-oblong, undulate, brownish purple, with a yellow margin; petals similar, toothed and spotted with purple brown; labellum quadrifid, cordate or oblong, fimbriate yellow, spotted with purple and rose; crest on the claw pectinate. Winter and spring. Colombia. G.C. II. 21:585; 25:140.—Owing to its wide geographical

1509. Odontoglossum grande.

scope, this species is extremely variable. A very mixed progeny has resulted from the crossing of this with other species, and the intermixture of the descendants. Var. **radiàtum,** Hort. (*O. radiàtum,* Reichb. f.). Sepals and petals narrow, yellow, heavily spotted with dark brown;

labellum expanded in front,white, shading into a brownish blotch at base. G. C. II. 25:76. Var. **crispàtum**, Reichb. f. Front half of the labellum convolute into deep folds, fimbriate. G.C. III. 5: 233. Not advertised. Var. **scéptrum**, Reichb. f. Sepals creamy yellow, barred and washed with brown; petals broader-toothed, densely spotted with brown; labellum whitish. I.H. 18:73; 37:99. Not advertised. Var. **Hýstrix**, Hort.(*O. Hystrix*, Hort.). Labellum much fringed, and crests very spiny.

9. **facètum**, Reichb. f. (*O. Hállii* Lindl.× *O. luteo-purpùreum*, Lindl.). Natural hybrid. Sepals lanceolate, straight, light yellow, with very large cinnamon-colored blotches; petals lanceolate, straight, finely toothed,with numerous small spots; labellum almost circular, short, finely fringed, convolute, undulate, light yellow, with a semi-circle of radiating keels, some of which are fringed and in front of which is a horseshoe-shaped spot.

10. **Hebràicum**, Reichb. f. (*O. cristàtum*, Lindl.× *O. cirrhòsum*, Lindl.). Natural hybrid. Fls. 2¼ in. across, borne in a paniele; sepals lanceolate; petals wider, undulate, all prettily marked, lemon-yellow, whitish in the center and spotted with red-brown markings suggesting Hebrew characters; labellum triangular or oblong, acuminate, erose-dentate, darker yellow toward the base, with a large maroon blotch and several smaller ones. Winter. Colombia. Gn. 21:339. G.C. II. 16:173. —Var. **aspérsum**, Rolfe. Differs slightly from the type in its lax racemes of golden yellow fls., blotched with purple-brown.

11. **maculàtum**, La Llave. & Lex Pseudobulbs ovate, 1-lvd.: lvs. lanceolate, acute, 6–8 in. long: raceme pendulous, loosely many-fld., longer than the lvs.: sepals narrowly linear or lance-oblong, acuminate, brown; petals ovate-lanceolate, acuminate, undulate, yellow, spotted with brown; labellum wide triangular, acuminate, crisp, yellow, brown-spotted, claw short, 2-crested: column white. Mexico. B.M. 6455 (not 4878, which is *O. cordatum*, Lindl.). B.R. 26:30.—Fls. freely in June. Racemes a foot long, with stellate fls. 3 in. in diameter. Var. **spléndens** and var. **supérbum** are recommended.

12. **mirándum**, Reichb. f. Lvs. lanceolate: raceme stiff, 1-sided: sepals and petals lanceolate-acuminate, almost wholly red-brown, with yellow margins; labellum linear-lanceolate, similarly marked, and having a few purple lines at base, callus horned: wings of the column rhomboid-serrate. Colombia.

13. **gloriòsum**, Linden and Reichb. f. Fls. pallid ochre, spotted with brown, paniculate; sepals and petals oblong-ligulate, acuminate; labellum lanceolate-acuminate, cordate at base, denticulate, about as long as the petals; claw with a 4-lobed, 4-toothed callus; column toothed below the middle. Colombia. G.C. 1865:578; II. 24:680.

14. **odoràtum**, Lindl. Pseudobulbs 2–3 in. long, narrowly ovoid, compressed: lvs. 1 ft. long, narrowly ensiform: panicle sometimes 2–3 ft. long, copiously branched and many-fld.: fls. 1½–2 in. across, dull golden yellow, blotched with brownish red; sepals and petals similar, narrowly lanceolate, acuminate, waved; labellum hastate, lateral lobes short, rounded; terminal lobe broadly subulate, narrowed, pubescent, waved; disk with 2 pairs of longitudinal, obtuse, erect teeth. Winter and spring. Mexico. B.M. 6502. G.C. II. 15:337. —Var. **latemaculàtum**, André. Fls. larger; spots purple-brown, larger and more intense. July, Aug. I.H. 17:39. Gt. 37, p. 492. Free-flowering.

SECTION II.

A. *Labellum more or less constricted in the middle, fiddle-shaped.*
B. *Column not winged, but having 2 projecting horns at the apex.* 15. **constrictum**
BB. *Column winged: wings pectinate or consisting of few decurved spines* 16. **Hallii**
BBB. *Column winged: wings toothed or entire.*
C. *Crest obsolete, 5-ridged* 17. **læve**
CC. *Crest falcate-pectinate* 18. **Wallisii**
CCC. *Crest of radiating keels toothed or entire* 19. **tripudians**
20. **Harryanum**
CCCC. *Crest a bifid callosity* 21. **Nevadense**
22. **Sanderianum**
AA. *Labellum with an ovate or oblong blade, often cordate at the base.*
B. *Lateral lobes not upright: labellum with a toothed crest* 23. **triumphans**
24. **aspersum**
25. **cristatum**
BB. *Lateral lobes on the claw fleshy, upright: labellum with obtuse crest or none* 26. **cordatum**
27. **Bictoniense**
AAA. *Labellum hastate* 28. **hastilabium**

15. **constrictum**, Lindl. Lvs. linear-lanceolate, elongate: panicle long, slender, loosely branched: fls. 1–1¼ in.; sepals and petals nearly similar, oblong-lanceolate, acuminate, bright yellow, blotched with orange-brown; labellum fiddle-shaped, with rounded or truncate, apiculate blade, white, with a rose-colored blotch on each side, toothed. Small-flowered, but a profuse bloomer, often bearing 4–5 many-flowered panicles 1–1½ ft. in length. Venezuela. B.M. 5736.—Var. **castàneum**, Hort. Spots on sepals and petals covering nearly the entire surface. I.H. 35:66.

16. **Hállii**, Lindl. Lvs. a foot long, ensiform, narrowed at the base: scape 1–2 ft. long, with a many-fld. raceme of equal length: fls. 3 in. across; sepals and petals spreading, sub-similar, oblong-lanceolate, long-acuminate with recurved points, golden yellow, with transverse bands and spots of yellowish brown; labellum white, with a blood-red spot on the middle lobe and few spots on the lateral ones, erose-dentate, mid-lobe emarginate, with a short awn in the sinus, with 2 spinous crests on the claw. July. Ecuador. B.M. 6237. I.H. 18:58. F.S. 17, p. 81. G.C. 1865:962; II.25:140.—The spots on the labellum are sometimes scattered.

17. **læve**, Lindl.(*O. Reichenheimii*, Linden & Reichb. f.). Lvs. 6–10 in. long, oblong-lanceolate: sepals and petals oblong-linear, acute, plaue, yellow, blotched with cinnamon; labellum smaller, white in front, violet on the upper half. Spring. Guatemala. B.M. 6265. I.H. 6:213. B.R. 30:39.—Plants bear 4–6 strict, stout panicles, 3 ft. long, with numerous fls. 2 in. in diameter. Not much esteemed.

18. **Wállisii**, Linden & Reichb. f. (*O. bállulum*, Hort.). Lvs. linear-lanceolate: sepals and petals ligulate, honey-colored, marked with brown streaks: labellum white, with a violaceous anterior part and marked with similar streaks at the base, with 3-falcate calli on the base. December. Colombia. I.H. 18:56; 38:127.—Elegant, with slender, drooping, mostly unbranched racemes, bearing few large flowers.

19. **tripùdians**, Reichb. f. and Warsz. Lvs. 7–9 in. long, linear-lanceolate: raceme stiff, erect, longer than the lvs., 8–10-fld.: fls. 2 in. across, dull yellow-green on the back; sepals oblong-acute or subacuminate, dark brown, with yellowish green tips and bases; petals similar, with yellowish bands; labellum short, panduriform, as long as the segments, white, with rose-colored blotches, with about 10 keels radiating from the disk; lateral lobes rounded, crenulate; central lobe subreniform, erose-dentate. Peru. B.M. 6029. F.M. 1876:208; 1880:407.

Var. **Harryànum**, Reichb. f. Sepals and petals almost blackish inside, tipped with light yellow, with a few similar marks at the base of the petal: labellum light yellow, with the base covered with rich mauve purple.

20. **Harryànum**, Reichb. f. Lvs. about 2, oblong-ligulate, obtuse, 6–12 in. long: raceme up to 3 ft. long, bearing 6–12 large fls.: sepals and petals ligulate-oblong, acute, wavy, brown with irregular, transverse, greenish yellow markings; the petals project forward; labellum large, flat, undulate, somewhat panduriform, lower half white, changing to yellow; upper half brownish marked with mauve lines and having about 7 serrated crests: column with 2 very small toothed wings. Colombia. Gn. 33:633. G.C. III. 2:169. Same as var. of No. 19

21. **Nevadénse,** Reichb. f. Pseudobulbs ovate, acuminate: lvs. linear-lanceolate, base narrow, keeled: sepals and petals similar, lanceolate, long-acuminate, dark brown with a golden margin, outside dark green; limb of the labellum wide, hastate, deflexed, fimbriate, white-spotted; apex acute, subincurved, appendage on the claw bifid. Spring. Colombia. I.H. 17:45. Gn. 19, p. 425; 32, p. 589; 39, p. 250. G.C. II. 16:461; 24:201.—A showy plant, with slender, arching, 6–10-fld. panicles, and fls. 3–4½ in. across.

22. **Sauderiànum,** Reichb. f. Resembling *O. Nevadense*. Fls. stellate; sepals and petals lanceolate, acuminate, yellow, with numerous chocolate-brown markings; labellum cuneate, panduriform, apiculate, toothed, white or pale yellow, with a purple blotch in front; lateral lobes erect. Early spring. Trop. America.—Free-flowering.

23. **triùmphans,** Reichb. f. Pseudobulbs 3–4 in. long: lvs. oblong-lanceolate, 1–1¼ ft. long: scape arching, branched and many-fld., 2–3 ft. long: fls. 3–4 in. across; sepals and petals lance-oblong, subacuminate, undulate, yellow, blotched with deep crimson-brown; labellum ovate, cordate, acute, toothed and undulate, white with a roseate tip; crest of yellow or white teeth. March, April. Colombia. I.H. 16:609. G.C. 1867:516; II. 24:205; 25:141; III. 27:213 (var.). R.B. 18:121. G.M. 34:89. F. 1877:217.

24. **aspérsum,** Reichb. f. (*O. maculàtum,* La Llave & Lex. × *O. Rossii,* Lindl.). Natural hybrid. Lvs. oblong, acute: raceme few-fld.: sepals ligulate, acute, keeled, pale yellow, mottled with numerous brown blotches; petals oblong, acute, much broader, similar in color; labellum with a cordate, acute blade wholly whitish, callus, toothed, yellow, with brown lines, pubescent. Feb., March.—Free-flowering.

25. **cristàtum,** Lindl. Lvs. linear-lanceolate, a little shorter than the many-fld. scape: sepals and petals lanceolate-acuminate, yellow, spotted with brown; labellum oblong-lanceolate, white; apex and margin brown, with purple striæ, with a digitate crest on the disk; wings of the column semi-ovate or subquadrate. Peru. I.H. 17:21.—Var. **Dayànum,** Reichb. This is colored like the type, but the lip is rhomboid, apiculate, serrate, and the teeth of the crests on the labellum cross each other like the bristles on the nearly closed leaf of *Dionæa muscipula*.

26. **cordàtum,** Lindl. Pseudobulbs oblong, 1-lvd.: lvs. oblong, acute, 6–8 in. long: fls. large and handsome, with the sepals and petals yellowish green, richly blotched with brown: labellum cordate, acuminate, subcrenate, white, with a purplish crest at base and spotted with brown on the limb; sepals lance-linear, acuminate; petals broader and longer, undulate. Mexico. B.M. 4878 (as *O. maculatum*). I.H. 26:355. P.M. 13:147. Gn. 27:475. F.C. 3:100.—Stem 2–3 feet high; few or many-flowered.

27. **Bictoniénse,** Lindl. Pseudobulbs oblong, 2–3 in. long, 2–3-lvd.: lvs. 1 ft. long, ensiform, undulate, spreading: raceme 3 ft. long: fls. 1½ in. across; sepals and petals subequal, linear-lanceolate, greenish yellow, blotched with brown; claw of the labellum bilamellate, blade cordate, acuminate, undulate, white or roseate. Autumn. Guatemala. B.M. 3812 (as *Zygopetalum Africanum*).—This was the first Odontoglossum to reach England in a living state. It is free-flowering, but not as good as plants subsequently introduced. Var. **álbum,** Hort. Like the type, but labellum pure white instead of wine-red; sepals and petals brown. I.H. 19:91.

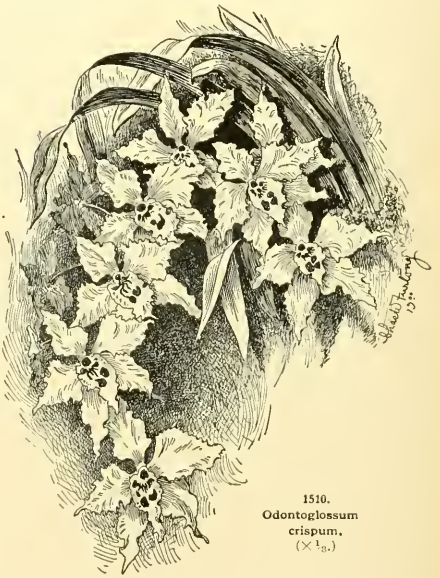
Var. **spléndens,** Ch. Lem. Labellum rose-lilac; other segments spotted. Seems to be like the type, with more pronounced color. I.H. 12:449.

28. **hastilàbium,** Lindl. Lvs. linear-oblong: scape 1½–2 ft.: bracts long, deciduous: fls. numerous, large, handsome, varied with pale green, purple and white, fragrant; sepals and petals spreading, lanceolate, very acuminate, pale green, with transverse purple dots and lines; labellum large, the lateral lobes forming 2 horns at base, the central one with a purple, crested claw, and orbicular-ovate, white, acute blade: column slender, winged, purple. Summer. Colombia. B.M. 4272.

SECTION III.

A. *Column without wings*.....29. **ramosissimum**
AA. *Column with 2 spreading awns*.30. **uævium**
31. **cirrhosum**
AAA. *Column pluricirrhose: segments lanceolate*.....32. **Ruckerianum**
AAAA. *Column with fimbriate or toothed wings: segments ovate or rhomboid*.....33. **nobile**
34. **crispum**

29. **ramosissimum,** Lindl. Lvs. linear-oblong, acute, 1 ft. long: panicle much branched and many-fld., 2 ft. long: fls. 2 in. across, white, spotted with pale purple or violet; sepals and petals very undulate, narrowly ligulate, the latter wider; labellum rhomboid, acuminate, cordate at base, crested, tomentose. March, Apr. Colombia. J.H. III. 29:77. I.H. 40:170 (var. **cœléste,** Linden & Rod.).—A distinct and beautiful plant whose fls. have been likened to large spiders.



1510. Odontoglossum crispum, (×⅛.)

30. **nævium,** Lindl. & Paxt. Pseudobulbs oblong: lvs. thin, lanceolate: panicle erect, arching, much branched, bearing numerous star-shaped fls.: sepals and petals 2 in. long, narrowly lanceolate, beautifully crenate-undulate, white, profusely spotted with rose-purple; labellum shaped nearly like the petals, shorter and broader, with 2 large crests on the yellow base. May, June. Colombia. F.S. 6:594. G.M. 31:559.—Closely allied to *O. cirrhosum*.

31. **cirrhòsum,** Lindl. Pseudobulbs lanceolate, compressed, 2–3 in. long: lvs. 4–6 in. long, linear-ensiform, leathery: panicle often over 2 ft. long, drooping or inclined: fls. 3 in. across, snow-white, blotched with crimson or brown, base of the labellum yellow, with brown lines at the sides; sepals narrowly lanceolate, ending in long, curved points; petals wider; labellum two-thirds the length of the petals, with 2 ciliate lateral lobes and a narrow acuminate middle lobe. Apr., May. Ecuador, Peru. B.M. 6317. I.H. 25:301. Gt. 41:1383. Gn. 9, p. 401; 16, p. 19. G.C. II. 5:501, 503; 9:181; 25:12. F.M.

1876:222.—This species sometimes produces stout few-fld. stems, which should be cut to save the vigor of the plant.

32. **Ruckerianum,** Reichb. f. Related to *O. crispum:* sepals and petals lanceolate, acute, creamy white, bordered with violet and spotted with brown, waved; labellum rather narrow, oblong, angular-lobed on each side of the base, yellow at base, with few chestnut-brown blotches; callus rhomboid serrate. Colombia. G.C. 1873:105; Il. 24:204, 748 (var. *insigne*). J.H. III. 30:455 (var. *splendens*).

1511. Habit sketch of Odontoglossum crispum.

33. **nóbile,** Reichb. f. (*O. Pescatórei,* Linden). Pseudobulbs ovate, bearing two strap-shaped lvs.: panicle 2–3 ft. long, diffuse, bearing numerous white, membranaceous fls. slightly tinged with rose: sepals ovate-oblong, slightly undulate; petals similar but much wider; labellum cordate-oblong, pandurate, with a yellow fimbriate crest and a few rose-colored spots. Spring. Colombia. F.S. 16:1624. I.H. 28:407. Gn. 21:330. G.C. Il. 24:212; III. 3:245; 7:200; 25:69. A.F. 5:183.—A fine species producing numerous large, erect panicles. Var. **Veitchianum,** Reichb. f. Like the type, but the parts of the flower have large, crimson-purple spots. Gn. 26:452.

34. **crispum,** Lindl. (*O. Blúntii,* Reichb. f. *O. Alexándræ,* Batem.). Figs. 1510 and 1511. Pseudobulbs ovate, compressed, about 3 in. long; lvs. linear, 1 ft. long; panicles rather short, but attaining a length of 2½ ft., with few short branches and crowded fls.: fls. white, variously spotted with crimson, brown, etc., or tinged with rose, 2–3 in. across; sepals ovate to ovate-lanceolate, often undulate; petals ovate to rhomboid, toothed and undulate-crisp; labellum oblong-ovate, fringed with teeth, wavy and crisp. Fls. are produced at any season of the year. Colombia. F.S. 16:1652. Gn. 4, p. 241; 20:291; 21, p. 95; 23, p. 210; 40, p. 596; 46, p. 149; 53, p. 297. R.B. 21:3. Gng. 6:24. J.H. III. 34:499. G.C. III. 21:363, 379; 23:165, 390; 25:67, 179, 187. A.F. 13:34. F.E. 9:327.—As was stated in the introduction, this species has probably more than a hundred named varieties. Many besides those cited have been figured in horticultural and botanical works. Very few varieties are found in American trade lists, but some of the most distinct are given below:

Var. **Andersonianum,** Hort. (*O. Andersoniànum,* Reichb. f.). Fls. creamy white, with broad, longitudinal bands of cinnamon. F.M. 1872:45. G.C. Il. 24:680, 681; III. 17:739.—Listed in America.

Var. **apiátum,** Ballantyne. Fls. very large; sepals and petals laciniate on the edges, white, with rich chocolate-brown blotches. G.C. III. 15:375.

Var. **Ashworthianum,** J. O'Brien. Fls. almost entirely rose-purple, with white margins and a few white marks on the sepals and petals. G.C. III. 19:197.

Var. **Gouvilleanum,** Ed. André. Fls. large, white; petals irregularly toothed, with few small crimson blotches; sepals heavily blotched. R.H. 1888:132.

Var. **guttátum,** Hort. (*O. Alexándræ,* var. *guttatum,* Hook.). Sepals linear-oblong, with several pale purple blotches; petals broader, similarly spotted; labellum oblong-quadrate, contracted in the middle, spotted with rose and having a large rose patch on the disk. B.M. 5697.

Var. **Lehmannii,** Hort. Labellum broadly ovate, bright ruby red, broadly edged with white; crest yellow; sepals and petals tinged with rose, with few red spots. G.C. III. 24:147.—In American trade.

Var. **maculátum,** Hort. Fls. white, spotted with purplish brown; petals suborbicular, laciniate-toothed. G.C. III. 16:248.

Var. **Mariæ,** Ed. André. Fls. pure white, except a few red spots on the base of the sepals. I.H. 25:325.

Var. **Schrœderi,** Hort. Fls. with 1 or 2 large and several small, brownish red spots on the white segments. Advertised in America.

Var. **Triánæ,** Hort. (*O. Alexándræ,* var. *Triánæ,* Hook.). Dorsal sepals with a single roseate spot; lateral sepals suffused and spotted with rose; petals pure white; labellum with a large 2-lobed spot. B.M. 5691.

Var. **Veitchianum,** Hort. Sepals ovate, undulate, white with several brownish crimson spots; petals broader, color like the sepals but mostly in one large central blotch; margins undulate and toothed. G.C. III. 1:799. F. 1884:177.

SECTION IV.

A. *Sepals and petals similarly colored.*
B. *Column without wings.*
C. *Pseudobulbs compressed and edged.*
D. *Labellum white or colored like the petals* ..... 35. **Madrense**
36. **nebulosum**
DD. *Labellum violet* ..... 37. **Krameri**
CC. *Pseudobulbs smooth, terete* .... 38. **Oerstedii**
BB. *Column with entire wings* ..... 39. **Cervantesii**
BBB. *Column with toothed or crenate wings.*
C. *Labellum reniform* ..... 40. **citrosmum**
CC. *Labellum oblong-quadrate* ..... 41. **pulchellum**
42. **Egertoni**
AA. *Sepals and petals dissimilar in color* ..... 43. **Rossii**
44. **Dawsonianum**

35. **Madrénse,** Reichb. f. (*O. maxillàre,* Hook.). Pseudobulbs long-ovoid; lvs. strap-shaped, 10 in. long; fls. 2½ in. across, 4–10 in a raceme; sepals and petals lanceolate, keeled, white, with a purple blotch at the base; labellum shorter than the sepals, the lateral lobes forming 2 acute recurved appendages on the claw, mid-

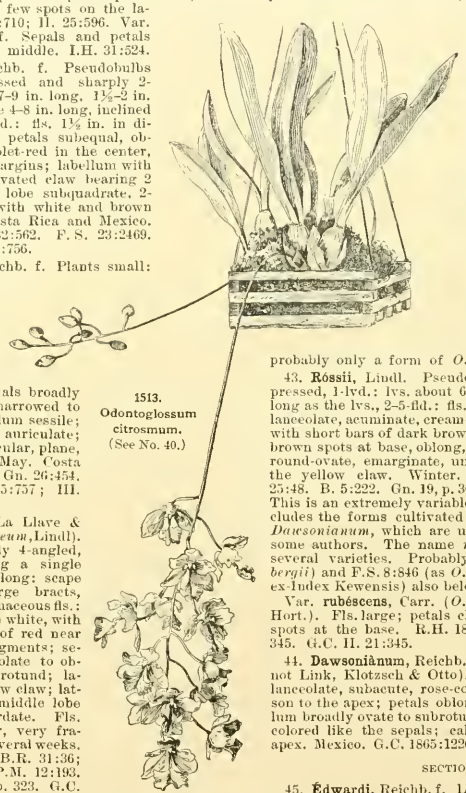
1512. Odontoglossum Cervantesii var. decorum (× ⅓).

dle lobe trowel-shaped, white, with a yellow base and an orange blotch. Summer. Mexico. B.M. 6144. I.H. 30:480. F.M. 1875:158. Gn. 10, p. 443. G.C. II. 25:116 (seed pod). G.M. 39:117.

36. **nebulòsum,** Lindl. (*O. marillàre,* Lindl.). Pseudobulbs 2-3-lvd.: lvs. oblong, acute, 9 in. long: scape about as long as the lvs., 5-6-fld.: fls. 3 in. across, pure white, with the bases of all the parts profusely spotted with brown; sepals membranaceous, oblong; petals similar but wider, all pubescent at the base; labellum with 2 large, erect lobes on the yellow claw; limb ovate, acute, dentate, pubescent. Mexico, at an elevation of 10,000 ft. I.H. 6:200. G.C. 1867:572 and II. 25:597. Not B.M. 6144, which is *O. Madrense.*—Var. **candidulum,** Reichb. f. Sepals and petals pure white, with a brown blotch and a few spots on the labellum. G.C. 1867:710; Il. 25:596. Var. **guttàtum,** Reichb. f. Sepals and petals spotted to above the middle. I.H. 31:524.

37. **Krâmeri,** Reichb. f. Pseudobulbs subrotund, compressed and sharply 2-edged, 1-lvd.: lvs. 7-9 in. long, 1½-2 in. broad, keeled: scape 4-8 in. long, inclined or pendulous, 3-5-fld.: fls. 1¾ in. in diameter; sepals and petals subequal, oblong-acute, pale violet-red in the center, with broad white margins; labellum with a stout yellow excavated claw bearing 2 erect calli; middle lobe subquadrate, 2-lobed, pale violet, with white and brown streaks at base. Costa Rica and Mexico. B.M. 5778. I.H. 32:562. F.S. 23:2469. G.C. 1868:98; Il. 25:756.

38. **Oérstedii,** Reichb. f. Plants small: lvs. linear-oblong, 4-5 in. long, narrowed to a petiole: raceme sub-erect, few-fld.: fls. 1¾ in. across, white, with the base of the labellum golden yellow; sepals and petals broadly oblong, the latter narrowed to a short claw; labellum sessile; lateral lobes small, auriculate; middle lobe suborbicular, plane, deeply bifid. Feb.-May. Costa Rica. B.M. 6820. Gn. 26:454. G. C. II. 7:811; 25:757; III. 19:77.



1513. Odontoglossum citrosmum. (See No. 40.)

39. **Cervántesii,** La Llave & Lex. (*O. membrandceum,* Lindl). Pseudobulbs usually 4-angled, 2 in. long, bearing a single oblong leaf 4-6 in. long: scape sheathed with large bracts, bearing 2-6 membranaceous fls.: fls. 2 in. across, pure white, with transverse streaks of red near the bases of the segments; sepals broadly lanceolate to oblong; petals ovate-rotund; labellum with a yellow claw; lateral lobes small; middle lobe large, broadly cordate. Fls. produced in winter, very fragrant and lasting several weeks. Mex. B.M. 4923. B.R. 31:36; 32:34. I.H. 1:12. P.M. 12:193. Gn. 19, p. 333; 32, p. 323. G.C. II. 15:753. F. 1881, p. 43.—Var. **màjus,** Hort. Fls. larger, with brighter spots. I.H. 25:313. Var. **décorum,** Hort. Fig. 1512. Fls. large, spotted inside and outside with bright red. I.H. 36:90. Gn. 32:617. J.H. III. 30:423. F.M. 1877:254. Var. **Andersoni,** Hort. Fls. white; base of the sepals and petals barred with reddish brown; labellum bordered with spots of the same color. Mexico.

40. **citrôsmum,** Lindl. Fig. 1513. Pseudobulbs subrotund, compressed, smooth, 1-lvd.: lvs. oblong, obtuse, thick, somewhat shorter than the raceme: scape pendent, 8-12-fld.: fls. large and full in outline, 3 in. across, white to rose, with a violet labellum; sepals and petals oblong, obtuse; labellum unguiculate, reniform. May, June. Guatemala. B.R. 29:3. R.B. 21:265. F.S. 6:633.

Var. **álbum,** Veitch. Fls. white, except the yellow claw of the labellum. Gn. 24:413. Var. **rosèllum,** Lemaire. Fls. rose-colored, except the yellow claw of the labellum. I.H. 2:59. Var. **róseum,** Veitch. Blade of the labellum deep rose. Var. **punctàtum,** Veitch. Fls. pale rose; sepals and petals spotted with purple. A variety called **máximum** is also advertised.

41. **pulchéllum,** Batem. Pseudobulbs oblong, compressed, 2-lvd.: lvs. grass-like, rather stiff or rigid, 9-12 in. long: scape weak, 6-7-fld.: fls. white, except the yellow crest of the labellum; sepals ovate, acute; petals obovate, acute, somewhat undulate; lateral lobes of the labellum triangular, middle lobe oblong, subquadrate, apex recurved; column very short, with 3 fimbriate wings. Spring. Guatemala. B. M. 4104. B.R.27:48.—Easily grown, and never fails to blossom. The flower-spikes suggest the lily-of-the-valley. Fragrant. Var. **màjus,** Hort. More robust than the type, with larger fls. Var. **grandiflòrum** is listed.

42. **Égertoni,** Lindl. Like *O. pulchellum,* but with the fls. only half as large: labellum acute, not almost truncate, excavated at the base and with 2 teeth inflexed over the excavation. Guatemala.—This is probably only a form of *O. pulchellum.*

43. **Rössii,** Lindl. Pseudobulbs small, much compressed, 1-lvd.: lvs. about 6 in. long: raceme about as long as the lvs., 2-5-fld.: fls. 2-3 in. in diameter; sepals lanceolate, acuminate, cream-colored to greenish yellow, with short bars of dark brown; petals white, with a few brown spots at base, oblong, obtuse, revolute; labellum round-ovate, emarginate, undulate, pure white, except the yellow claw. Winter. Mex. F.C. 3:129. B.R. 25:48. B. 5:222. Gn. 19, p. 306; 28:507. F.S. 20:2110.—This is an extremely variable species, and probably includes the forms cultivated as *O. Ehrenbergii* and *O. Dawsonianum,* which are united with this species by some authors. The name *majus* has been applied to several varieties. Probably I.H. 1:30 (as *O. Ehrenbergii*) and F.S. 8:846 (as *O. Ehrenbergii* = *O. apterum,* ex-Index Kewensis) also belong here.

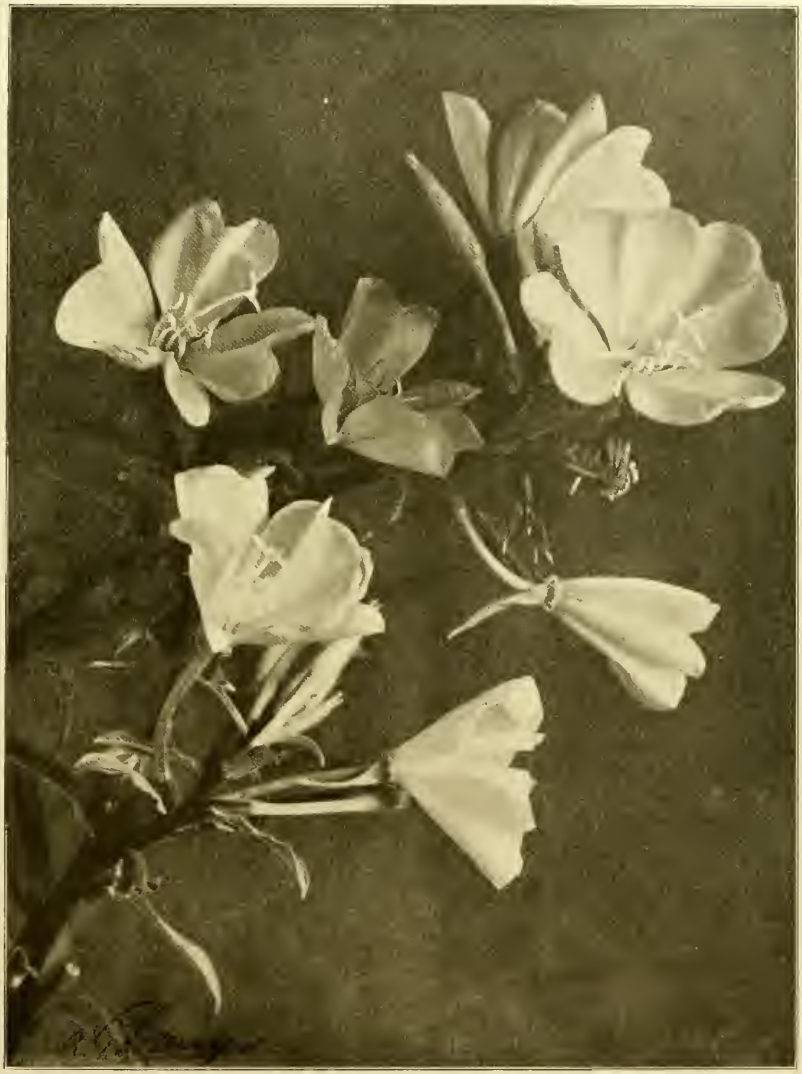
Var. **rubéscens,** Carr. (*O. Rossii majus rubescens,* Hort.). Fls. large; petals clear rose, with dark brown spots at the base. R.H. 1886:492. Gn. 28:507; 39, p. 345. G.C. II. 21:345.

44. **Dawsoniânum,** Reichb. f. (*O. Éhrenbergii,* Hort., not Link, Klotzsch & Otto). Raceme few-fld.: sepals lanceolate, subacute, rose-colored, blotched with crimson to the apex; petals oblong, acute, pure rose; labellum broadly ovate to subrotund, crenulate; apex retuse, colored like the sepals; callosity with 2 teeth at the apex. Mexico. G.C. 1865:1226; II. 25:469. F.S. 17, p. 76.

SECTION V.

45. **Édwardi,** Reichb. f. Lvs. 2 ft. long, strap-shaped: panicle suberect, curved, 2 ft. long, the rachis bearing many horizontal branches covered with many rather small dark purple flowers: sepals and petals oblong to ovate-obtuse, reflexed and wavy; labellum tongue-shaped, obscurely lobed, with a prominent yellow lobulate callus on the disk. Spring. Ecuador. B.M. 6771.—A distinct plant, easily cultivated.

Supplementary list of synonyms and imperfectly known kinds: *O. Arnoldiânum.*—*O. blândum,* Reichb. f. Sepals and petals cuneate-lanceolate, acuminate, pale yellowish white, spotted with crimson-brown; labellum ovate, acuminate, crisp. Resembling *O. nævenm,* with the labellum much broader. Winter and spring. Columbia. Fls. in a nodding raceme, creamy white, spotted with reddish purple; labellum white, spotted like the petals and stained with yellow at the base.—*O. Dawiânum.* Perhaps a misprint for Dawsonianum



One of the evening Primroses.—Œnothera

— *O. delicatum.*— *O. Edgertonianum* is probably Egertoni.— *O. Karwinskii*, Reichb. f., is probably a synonym of O. leve. — *O. tegardinum.* See No. 5.— *O. Phalænopsis*, Linden & Reichb. f.=Miltonia Phalænopsis.— *O. Roezlii*, Reichb. f. =Miltonia Rœzlii.— *O. splendens.*— *O. vexillarium*, Reichb. f.= Miltonia vexillaria.— *O. Victoriense* and vars. album and superbum.— *O. Wärneri*, Lindl.=Oncidium Warneri.— *O. Warscewiczii*, Reichb. f.=Miltonia Endresii.— *O. Weltoni*, Hort.=Miltonia Warscewiczii.

HEINRICH HASSELBRING.

ŒCÓCLADES. See under *Dendrophylax.*

ŒNOTHÈRA (said to be Greek for *wine-scenting;* in allusion to the aucient use of the roots). *Onagràceæ.* EVENING PRIMROSE. Herbs, or sometimes shrubby at the base, with alternate simple or pinnatisect leaves and mostly showy fls., which are yellow, white or rose-color: calyx with a tube prolonged beyond the angled or cylindrical ovary, with 4 usually strongly reflexed lobes; petals 4, mostly obovate or spatulate; stamens 8, with narrow mostly versatile anthers: fruit a 4-valved locnlicidal capsule. The Œnotheras are mostly dry-soil plants and are chiefly North American. Some of them are South American, and Bentham & Hooker admit one plant which grows in Tasmania. The genus is polymorphous, and there is consequently great difference of opinion as to generic bounds. What is commonly regarded as one genus is broken up into ten or a dozen genera by some authors. These minor genera are here treated as subgenera, for the group is fairly homogeneous from the horticultural point of view, and an entirely new set of names in several strange genera could scarcely be forced on the trade. The Godetia section contains some excellent flower-garden plants, and some of the true Œnotheras make glowing displays of yellow in the border; but the greater number of the species are of only secondary importance to the cultivator. Amongst the best of the border-plant species are *Œ. fruticosa*, var. *Youngii*, *Œ. glauca*, var. *Fraseri*, *Œ. cæspitosa*, *Œ. Missouriensis*, *Œ. speciosa.* For a botanical revision of the North American species, see Sereno Watson, Proc. Amer. Acad. Arts & Sci. 8:573 (May 13, 1873).

L. H. B.

There is nothing special to say about the culture of Œnotheras except to note the tender kinds and the biennials. All do well in ordinary garden soil, enjoying sunshine. They are easily raised from seeds and cuttings. *Œ. acaulis*, *eximia* (properly *Œ. cæspitosa*) are low-growing biennials which do well treated as annuals. They will not endure the winter. *Œ. Missouriensis* is a splendid trailer, with enormons yellow flowers, and seed vessels. It is quite hardy, and a fine rock garden plant. *Œ. biennis*, the common Evening Primrose, is rather weedy, and only fit for the wilder parts of the garden. *Œ. biennis*, var. *grandiflora*, is a better form. *Œ. fruticosa* and *Œ. Fraseri* are two of our best border kinds, with stiff, branching stems. *Œ. linearis* is a pretty little species, often naturalized but well worth growing. Childs' Mexican Primrose is tender, but makes a pretty plant for hanging pots. *Œ. speciosa* is a very fine species, but spreads so quickly by undergrondt stems as to become a weed in favorable situations: it is good for naturalizing in wild grounds.

T. D. HATFIELD.

Œnothera is represented in Colorado by a diversity of specific forms which have been segregated into no fewer than six genera. Of these nearly all are perennial, *Œ. albicaulis*, Pursh, being an interesting exception. Of the perennials, *Œ. serrulata* will bloom the first season from seed, and probably some others will if sown early. A few kinds are slow to germinate, notably *Œ. brachycarpa* and *Œ. cæspitosa*, which usually produce some plants the first season, but most of the seeds remain dormant until the second year. *Œ. brachycarpa* includes two forms of specific rank, the typical form belonging to the western slope of the Rocky mountains and agreeing with Britton & Brown's description and illustration, but flowers 2 inches broad, seeds purplish black. The *Œ. brachycarpa* of the eastern slope, so called by botanists and collectors, has flowers 4 to 5 inches broad, capsnle 1½ to 2 inches long (!), broadly winged, seeds larger than of any other species, of angular form, light brown. Foliage resembling that of *Œ. Missouriensis* and seems to be most nearly related to the latter species. The western type seems not to be in the trade.

As to culture, most sorts seem to prefer a porous soil with a rather large proportion of sand, an ideal soil consisting largely of decomposed granite with some vegetable matter. They seem to be quite adaptive, and *Œ. brachycarpa*, *Missouriensis*, etc., are found sometimes in stiff clay soil. An abundance of sunshine is natural to most sorts.

D. M. ANDREWS.

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I. SUBGENUS TARAXIA. *Stemless, usually perennial: stigma capitate: calyx-tube filiform; capsule sessile, narrow to ovate, usually not winged: fls. yellow.*

1. **ovàta,** Nntt. Perennial, slightly pubescent: lvs. ovate to lance-oblong, 8 in. or less long, acute, serrulate: calyx-tube sometimes 4 in. long, the petals less than 1 in. long and yellow: fl.-bud erect: capsule ½ in. long. Calif.

II. SUBGENUS SPHÆROSTIGMA. *Stem-bearing: stigma capitate: calyx-tube short, inversely conic or funnelform: capsule sessile, linear, not winged: fls. various.*

2. **bistórta,** Nntt. One to 2 ft., the base decumbent, hairy and pubescent: radical lvs. spatulate to lanceolate and petiolate, dentate: stem lvs. mostly sessile-ovate to narrow-lanceolate and about 1 in. long, dentate: fls. yellow, turning green, the petals (about ½ in. long) usually with a brown spot at the base: calyx-tube 1–3 in. long; capsule ¾ in. or less long, 4-angled, contorted. S. Calif.

Var. **Veitchiàna,** Hook. More slender: radical lvs. narrow-oblanceolate and long-petioled: capsule longer and narrower (1–1½ in. long) and little contorted. S. Calif. B.M. 5078.

3. **cheiranthifòlia,** Hornem. Stems decumbent or ascending, 2 ft. or more tall, canescent: lvs. thick, about 1–2 in. long, broad-ovate to lanceolate or the lower ones spatulate, the upper ones becoming sessile, most of them entire: petals yellow, ¼–⅓ in. long: capsule ¾ in. or less long, curved, somewhat hairy. Calif. B.R. 12:1040.

III. Subgenus Meriolix. *Stem-bearing: stigma disk-like but 4-toothed: calyx-tube shorter than the ovary, enlarging upward: capsule linear or nearly cylindrical, sessile: fls. yellow, axillary.*

4. **serrulàta,** Nutt. Slender, simple or branched, about 1 ft. high but variable in stature, nearly glabrous to canescent: lvs. linear to lanceolate, 1–3 in. long, usually acute, attenuate to the base, sharply dentate: petals broad-obovate, ¼ in. long, wavy-margined. Minn., west and south. Biennial or perennial. Mn. 7:41.

1514. Capsules of evening Primrose (× ¼).

IV. Subgenus Onagra. *Stem-bearing: stigma 4-cleft: calyx-tube elongated and cylindrical, enlarging at the throat: capsule linear-oblong to long-conic, 4-angled: fls. yellow, opening in evening.*—True Evening Primroses.

5. **biénnis,** Linn. Common Evening Primrose. Fig. 1514. Tall, strong, simple or branching biennial (often 4–5 ft.), closely pubescent or somewhat hairy: lvs. lanceolate to oblong to ovate-lanceolate, often 6 in. long, acute, remotely denticulate, the lowest ones petioled: calyx-tube 1–2 in. or more long: petals bright yellow, ¾ in. or less long: capsule pubescent or hairy, often 1 in. long. Generally distributed, and now a common weed in the Old World. Gn. 26, p. 480.—The fls. open suddenly at nightfall. It is a weedy plant and has little to recommend it to cultivation, although it is offered by dealers. In France the thickened roots are mentioned as an edible vegetable, to be used after the manner of salsify or vegetable oyster. The root should be eaten, according to Vilmorin, "at the end of the first year of its growth."

Var. **grandiflòra,** Lindl. (*Œ. Lamarckiàna,* Ser.). Fls. much larger, the petals 1–2½ in. long. Very showy when the fls. open. Commoner westward. B.M. 2068. B.R. 19:1604. Gn. 26, p. 482; 46, p. 64.

V. Subgenus Œnothera. *Stem-bearing: stigma deeply 4-cleft: calyx-tube very long and filiform or linear: capsule narrow-cylindric, obtusely 4-angled, with numerous seeds in 2 rows in each locule: fls. yellow, mostly showy.*

6. **Drùmmondii,** Hook. Fig. 1515. One to 2 ft., from an oblique or decumbent base, loosely pubescent: lvs. lance-oblong or oblanceolate, acute, either gradually or abruptly tapering into a short petiole, entire or slightly toothed: calyx-tube usually 2 in. long and very narrow: fls. 2–3 in. across, nocturnal, bright yellow, showy: capsule 1–2 in. long. Texas. B.M. 3361.—Perhaps biennial, but grown as an annual.

VI. Subgenus Anogra. *Stem-bearing: stigma deeply 4-cleft: calyx-tube elongated and enlarging upwards: capsule oblong or linear: fls. white or pink, opening by day.*

7. **albicaùlis,** Pursh (*Œ. pinnatífida,* Nutt.). Low (1 ft. or less tall), stems white and shreddy, the branches ascending, slightly pubescent or sparsely hairy: lvs. lanceolate, oblanceolate or lance-oblong in outline, deeply pinnatifid or some of the larger ones only strongly toothed, 4 in. or less long, sessile or nearly so: fls. large (3 in. or less across), diurnal, white and fading to rose, the petals obcordate. Prairies, west. B.R. 14:1142 (as *Œ. pallida*).

8. **Califórnica,** Wats. (*Œ. albicaùlis,* var. *Califórnica,* Wats.). Smaller and hoary-pubescent or villous, the stems only 3 or 4 in. long: lvs. narrow-oblanceolate and acuminate, usually stalked, toothed or pinnatifid: fls. often larger, fragrant, the petals lobed. Central and southern Calif.

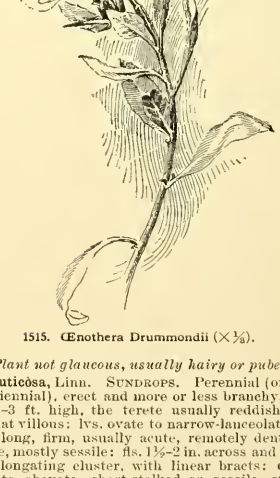
VII. Subgenus Megapterium. *Stem-bearing: stigma 4-cleft: calyx-tube very long and slender, enlarging at the top: capsule very broad and strongly 4-winged: fls. yellow, showy.*

9. **Missouriénsis,** Sims (*Œ. macrocárpa,* Pursh). Low, with a hard base, the ascending stems usually not over 1 ft. long, usually pubescent: lvs. thick, varying from oval to linear to narrow-lanceolate, 3 in. or less long, acuminate, narrowed to a petiole, entire or remotely denticulate: petals 1–2½ in. long, very broad, yellow: capsule 2–3 in. long and nearly as wide, broad-winged. Mo. and Neb. to Tex. B.M. 1592, Gn. 26, p. 480. R.H. 1857, p. 598.

VIII. Subgenus Kneiffia. *Stem-bearing: stigma deeply 4-lobed: calyx-tube very slender, somewhat dilated at the top: capsule rather small, club-shaped, 4-angled or narrowly 4-winged: fls. yellow, diurnal.*

A. *Plant more or less glaucous, glabrous.*

10. **glaùca,** Michx. Erect perennial, 2–3 ft.: lvs. ovate to ovate-oblong, 4 in. or less long, acute or somewhat obtuse, sessile, remotely denticulate: fls. large, in short leafy clusters, the calyx-tube about ¾ in. long; petals an inch long, more or less emarginate: capsule oblong, broad winged, short-stalked. Va., Ky., and south. B.M. 1606.—Var. **Fràseri,** Torr. & Gray (*Œ. Fràseri,* Pursh), is a form with ovate-lanceolate often slightly petioled lvs. Southern states. B.M. 1674.



1515. Œnothera Drummondii (× ⅛).

AA. *Plant not glaucous, usually hairy or pubescent.*

11. **fruticòsa,** Linn. Sundrops. Perennial (or sometimes biennial), erect and more or less branchy, rather stout, 1–3 ft. high, the terete usually reddish stems somewhat villous: lvs. ovate to narrow-lanceolate, 3 in. or less long, firm, usually acute, remotely denticulate or entire, mostly sessile: fls. 1½–2 in. across and showy, in an elongating cluster, with linear bracts: capsule oblong to obovate, short-stalked or sessile, strongly winged. Dry soil, Nova Scotia, south and west. B.M.

332.—Very variable. Var. **Yoùngii** (*Œ. Yoùngii*, Hort.) is common in cultivation, and is prized for its stocky growth and profusion of bloom. It is a strong, larger-leaved plant, with firm, shiny, slightly glaucous foliage, and bearing many bright lemon-yellow flowers: 2 ft., much branched and somewhat decumbent at base. Excellent. Var. **màjor**, Hort., is a strong-growing floriferous form, forming a dense bush-like specimen.

12. **lineàris**, Michx. (*Œ. fruticòsa*, var. *lineàris*, Wats. *Œ. ripària*, Nutt.). Usually lower and more slender: lvs. linear to narrow-lanceolate: capsule mostly less broadly winged, clavate. Conn., south. Gn. 26, p. 481.

13. **pùmila**, Linn. Slender, erect biennial: lvs. oblanceolate or oblong, usually glabrous, entire, the radical spatulate: fls. an inch or less across in a loose, leafy spike or raceme, the calyx-tube shorter than the ovary, the petals obcordate: capsule mostly clavate, short-stalked or sessile. Nova Scotia, south.

IX. Subgenus Hartmannia (*including Xylopleurum, etc.*). *Stem-bearing: stigma 4-lobed: calyx-tube funnelform, often very long: capsule club-shaped or obovate, broad-winged: fls. white, pink or red, diurnal.*

A. *Plant canescent or villous, usually erect, or at least prominently ascending.*

14. **speciòsa**, Nutt. Perennial, with a rootstock, erect or ascending branches, 2 ft. or less high, canescent: lvs. linear to lance-oblong, 4 in. or less long, remotely or sinuately dentate, or the lower ones pinnatifid, attenuate at base: calyx-tube as long as the ovary; petals large, obcordate, white: capsule ½–¾ in. long, 8-winged, acute at top. Mo., W. and S. B.M. 3189. Gn. 26, p. 482.

15. **tetráptera**, Cav. Villous: capsule larger and more broadly winged, very abruptly contracted at top: calyx-tube shorter than the ovary: fls. white, becoming rose. Texas, south. B.M. 468. Var. **Chìldsii** (*Œ. ròsea Mexicàna*, Hort.) is a handsome form introduced from Texas by John Lewis Childs in 1892. It was found in the wild. "We first secured the pink," Mr. Childs writes, "and afterwards someone else sent us the white, blush and the other shades, all from Texas." In some respects it differs markedly from *Œ. tetraptera*, and it is not impossible that it is a distinct species. In cultivation it is a trailing plant. The lvs. tend to be broader and less pointed than in *Œ. tetraptera*. It does not produce seed in the North, but is readily propagated by cuttings. It is an excellent plant either for the flower garden or for pots in the conservatory. It is popularly known as the "Mexican Evening Primrose."

16. **ròsea**, Ait. Root biennial or perennial: stem erect or ascending, 1–2 ft., branching from the base: lvs. lanceolate to narrow ovate-lanceolate, mostly acuminate, rather abruptly narrowed to a petiole, entire or remotely denticulate or the larger ones small-lobed at the base: calyx-tube shorter than the ovary: fls. small, fuchsia-like, purple or rose, the petals rounded and entire: capsule like that of *Œ. speciosa*. Texas and New Mexico, south. B.M. 347.—Offered by seedsmen.

AA. *Plant glabrous or essentially so, nearly stemless or else prostrate.*

17. **acaùlis**, Cav. (*Œ. taraxacifòlia*, Hort.). Tufted perennial or biennial plant, at first stemless, but producing prostrate, somewhat zigzag stems: lvs. oblong in outline, 5–8 in. long, petioled, divided into many unequal narrow divisions (like a dandelion leaf): fls. usually opening white, but changing to rose, large (2–3 in. across), the very slender tube 3–5 in. long: capsule short-obovate, broadly triangular-winged above. Chile. B.R. 9:763. Gn. 26, p. 480.—A very interesting plant.

X. Subgenus Pachylophus. *Stemless or essentially so: stigma 4-cleft: calyx-tube very slender but enlarging upwards, longer than the ovary: capsule with wrinkled or contorted wings: fls. white or pink.*

18. **cæspitòsa**, Nutt. (*Œ. exìmia*, Gray. *Œ. marginàta*, Nutt.). Crown 2–4 in. high, perennial or biennial: lvs. clustered, oblong to narrow-lanceolate or spatulate, sometimes 1 ft. long, attenuate, repand-toothed, pubescent: fls. white or pink, 1⅓–3 in. across, the petals obcordate; calyx-tube 2–6 in. long: capsule oblong-pointed, 1–2 in. long. Neb., west and south. B.M. 1593, 5828. Gn. 26:469; 47, p. 46.

XI. Subgenus Lavauxia. *Stemless or essentially so: calyx-tube very slender, enlarging upwards, longer than the ovary: capsule with plane or entire wings: fls. white, pink, or even pale yellow.*

19. **brachycárpa**, Gray. Perennial, densely pubescent: lvs. thickish, ovate to very narrow-lanceolate, about 6 in. long, long-stalked, entire or notched or lyrately pinnatifid: calyx-tube 2–3 in. long; petals about 1½ in. long, purplish: capsule ovate, often 1 in. long, the wings not wrinkled. Kansas, west and south.

1516. Godetia amœna.
G. rubicunda splendens of the trade (× ¾).

XII. Subgenus Godetia. *Stem-bearing: calyx-tube short and usually broad: capsule ovate or linear, 4-sided, not winged: fls. lilac, purple or rose, showy.*

The Godetias are very showy garden annuals, with brilliant pink or red-purple flowers of satiny luster. They are generally of easy culture in any warm garden spot, although sometimes subject to what appears to be a disease of the root. They are excellent subjects for pot culture, either under glass or in the open. The garden forms are derived from two species.

20. **amœna**, Lehm. (*Œ. Lìndleyi*, Dougl. *Œ. ròseo-álba*, Hornem. *Œ. bìfrons*, Lindl., not Don. *Œ. purpùrea*, Hort., not Curt. *Godètia rubicúnda* and *G. vinòsa*, Lindl. *G. Lindleyàna*, Spach. *G. Nivertiàna*, Goujon). Fig. 1516. Rather small, often slender, small-leaved, the lvs. usually linear to narrow-lanceolate or

small-oblong, entire or nearly so: fls. 1–1½ in. across, white or rose or light-purple, rarely conspicuously spotted in the throat, scattered on leafy branches: stigma lobes about 1½ lines long: capsule 1½ in. or less long, tapering at both ends, on a pedicel ½ in. or less long, the seeds in one row in each locule. Pacific coast, from Vancouver Island southward. B.M. 2832. B.R. 17:1405, 22:1856, 1880. R.H. 1872:430.—The common old-time garden Godetia, and much given to dwarf forms. One of the best forms is known in the trade as *Godetia rubicunda splendens* (Fig. 1516). A common form is known as Bijou. There are double forms.

1517. Œnothera Whitneyi.
Godetia Whitneyi of the trade (×⅓).

21. **Whitneyi,** Gray (*Œ. grandiflòra,* Wats., not Hort. *Godètia grandiflòra,* Lindl. *G. Whitneyi,* Moore. *G. gloriòsa,* Hort.). Stouter, broader-leaved, compact in growth: fls. 2–4 in. across, light purple, with dark purple spot at the throat on each petal, borne in a short, dense, not leafy spike or raceme; stigma lobes 3 lines long: capsule about 1 in. long, oblong or linear, the seeds in two rows in each locule. N. Calif. B.M. 5867. B.R. 28:61. R.B. 21:193.—The large-flowered Godetia of gardens, giving rise to such varieties as Lady Albemarle, Duke of Fife, Duchess of Fife, Duchess of Albany, Grandiflora maculata, Brilliant.

22. **quadrivúlnera,** Dougl. (*Godètia quadrivúlnera,* Spach). A very slender species 1–2 ft.: lvs. linear or nearly so, sessile, or with a very short, narrowed base, entire or nearly so: fls. about ½ in. across, purple, with eroded petals; stigma-lobes short: capsule ½–¾ in. long, 2-ribbed at the alternate angles, sessile, with seeds in 1 row. Calif. B.R. 13:1119.—Once offered by Orcutt.

Œ. splèndens, "light yellow," appears in trade lists, but its identity is unknown to the writer. The name splendens is also commonly used for a form of Godetia amœna.

L. H. B.

OHIO, HORTICULTURE IN. Fig. 1518. Ohio lies in nearly a square body, about 200 miles from north to south and the same from east to west. The surface is undulating, being somewhat hilly in some portions, particularly in the southeast and along the Ohio river, and quite level in the northwestern part of the state.

There are no great elevations nor large bodies of water in the interior to modify the climate. Lake Erie, on the north, exerts considerable influence for some distance along its shores, but there are no wide climatic variations between different parts of the state. The range in temperature is considerable, sometimes reaching 98° in summer and falling as low as 30° below zero in winter, although such extremes seldom occur in the lake region. Some of the more tender fruits and ornamental plants often suffer because of low temperatures, but all horticultural products which can be grown in the same latitude are successfully cultivated within the state. The annual rainfall is about 38 inches, and severe droughts seldom occur.

Ohio has great horticultural possibilities, none of which are fully developed, but along some lines the limit seems to be almost reached; at least until wider markets are opened. The market for Ohio's horticultural products is mostly within the borders of the state, the most notable exceptions being grapes, strawberries and celery, these articles being shipped to other states in large quantities. The outside trade in nursery products is also considerable, the exports of trees and plants being much more than the imports.

To the awakening of interest in horticulture and dissemination of horticultural knowledge, much is due to the efforts of such men as Kirtland, Warder, Elliot, Bateham, Campbell and Ohmer. The first united efforts of early horticultural workers was in the organization of the Ohio Pomological Society, in 1847. The name was afterward changed to the Ohio State Horticultural Society. This organization remains active at the present time, and during the entire period of its existence has numbered among its members many of the foremost horticultural workers in the state. Its influence has been widely felt, both directly through its members and publications, and indirectly through the county and local societies, a number of which are offspring of the state society.

The State University and State Experiment Station have, in recent years, exerted a decided influence on the horticulture of the state in helping to a better knowledge of plant diseases and insects, and to methods of controlling them, as well as in special horticultural work, pertaining to methods, varieties, etc.

Anything like a complete statistical review of the horticultural products of the state would be impossible, for such statistics have not been gathered for all crops. Statistics of this kind have only a transient value, however, and hence may well be dispensed with, except in a few cases where comparisons need to be made.

Apples are grown in all parts of the state, and, while some sections are better adapted to apple culture than others, there can hardly be said to be any well-defined apple belts within its borders, as shown by the orchards planted. There are commercial orchards in all parts of the state where alluvial soils abound, except in limited areas of the northwest. But few large orchards are found in any part of the state. Orchards exceeding 50 acres in extent are rare. The apple crop of the state is of considerable commercial importance, however, as shown by the fact that it often reaches a total of 17,000,000 bushels. Owing to the fact that the majority of the orchards are not planted for commercial purposes, much of the fruit produced is inferior in quality. Commercial orchardists, however, are giving considerable attention to spraying and other necessary details in orchard management, and are securing very satisfactory results.

Although the state is but little more than 200 miles across from north to south, there is a notable difference in the varieties of winter apples grown in the extreme northern and southern portions. The Baldwin is the leading variety in two or three tiers of counties lying along the lake; Rhode Island Greening finds a congenial home in this section also, and the Northern Spy in the northern tier of counties. None of these varieties is

satisfactory below the central portion of the state. Rome Beauty is the leading sort in the southern part and is most at home in the counties lying along the Ohio river. Ben Davis is well adapted to the same section also. The Willow Twig is very satisfactory along the river in the eastern part of the state. Grimes Golden, Jonathan, York Imperial, and Hubbardston are found to be very satisfactory winter sorts in nearly all parts of the state. Of early varieties, essentially the same sorts are grown in all sections.

1518. Ohio, to show horticultural regions.

The conditions for successful peach culture are more favorable along the shore of Lake Erie than any other part of the state. Ottawa county is the center of peach culture in this section, Catawba Island taking the lead. In this locality the vineyards have been almost wholly replaced by peach orchards. The same state of affairs exists in a less marked degree ou the adjacent islands and peninsula. Athens, Muskingum and Coshocton counties, in the southern and central parts of the state, produce large quantities of this fruit also. There are about half a dozen other counties in which peach culture is made a special feature of fruit-growing, but the industry is not developed to the extent that it is in those above named. In 1896 the total peach crop of the state was nearly 2,000,000 bushels, and of this Athens, Muskingum, Coshocton and Ottawa counties produced more than one-fourth. Mountain Rose, Oldmixon, Elberta, Smock, and Salway are the varieties most commonly grown.

There are no large areas of pear, plum and cherry production in the state, although a considerable number of cherry orchards have been planted near Clyde, in Sandusky county. Japan plums have not generally proved reliable. Red June, Burbank and Chabot have proved the most satisfactory of any. None are reliably hardy. Of grapes, there are about 15,000 acres within the state, nearly all of which are along the lake shore and on the islands near Sandusky, Cuyahoga county taking the lead with about 4,000 acres of vineyards. Owing to low prices of grapes, plantings have been limited in recent years, but not many vineyards have been destroyed, except to give place to peach orchards. Concord, Worden, Delaware and Catawba have been planted more than any others.

Small fruits sufficient for the home demand are grown in nearly all sections, but the shipping trade is less than formerly; hence the acreage devoted to these fruits has fallen off in some localities. The total acreage has not fallen off, but there has been an increase rather, and the cultivation of these fruits has become more general. In both area and product strawberries take the lead, followed by black raspberries, blackberries, red raspberries, currants and gooseberries, in the order named. The demand for black raspberries has fallen off considerably of late, and the acreage has decreased in consequence. Market-gardening is carried on mostly to supply local markets, but there are a few specialties which are grown on a large scale in a number of localities.

Early tomatoes and cucumbers are grown in large quantities along the Ohio river for northern markets, and the same is true, to a less extent, of melons. Large celery and onion farms exist in Hardin, Huron, Median, Wayne, Cuyahoga, Summit and Stark counties. Reclaimed swamps consisting of muck are used for this purpose. In Ross county the growing of onion sets has become a large industry, the soil in this case being alluvial.

Several pickling establishments are in operation in various parts of the state, and for these are grown many thousands of acres of cucumbers and cabbage. A number of canning factories are found within the state, and these take the products of large areas of tomatoes and sweet corn. Fruit is not used in the canneries very largely, nor are peas, except in a few cases.

Vegetable-growing under glass is practiced in or near nearly all towns of a few thousand inhabitants. The business has assumed very large proportions near Toledo, Cleveland and Ashtabula. In nearly all cases greenhouses of the best form of construction are used, and are mostly heated by hot water. About Cincinnati, hotbeds are more common than elsewhere. This is the center of radish production, but lettuce is the leading crop in greenhouses. The houses are occupied with the crop from September until May, and about the middle of February tomatoes or cucumbers are planted in the lettuce beds. These crops are in bearing during May and June. Tomatoes and cucumbers are seldom grown as winter crops, as lettuce is more profitable and more easily grown in midwinter than either of the others. Grand Rapids lettuce is grown almost exclusively.

Floricultural establishments are found in all parts of

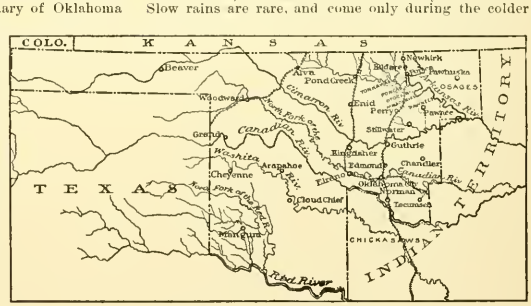
the state, in most localities the products being for the home demand only, but large concerns at Painesville, Calla, Springfield and Dayton have an immense shipping trade of plants, the mailing trade being particularly large. Cut-flowers are grown in considerable quantities also, the principal centers being Cleveland and Cincinnati. Large nursery centers exist at Painesville, on the lake shore, and in the Miami valley, near Dayton and Troy. The stock grown in these and other nurseries of the state consists mainly of fruit trees and small fruit plants. Ornamental trees and plants are grown in comparatively limited quantities, for the reason that landscape gardening and ornamental planting have not been given due attention. More or less pretentious park systems are in a state of development in some of the larger cities, Cincinnati, Cleveland and Toledo leading in this respect. A number of cemeteries show considerable care in maintenance and some skill in planting, but well-arranged private grounds are rare. Spring Grove cemetery, in Cincinnati, was one of the first large landscape cemeteries in the world. Mount Auburn, in Cambridge, was the first rural cemetery in this country. See *Landscape Gardening* and *Strauch*.

While landscape art is in a rather backward condition within the state, there is quite a fund of accumulated knowledge regarding the adaptability of species and varieties of trees and plants to this climate. It would be too broad a statement to say that foreign species do not succeed here, but so many have been disappointing that there seems to be little of any value left. Fortunately there is an abundance of suitable material in our own and neighboring states.

Ohio is a great agricultural state, and this fact has somewhat retarded horticultural development, but, on the other hand, large manufacturing interests have had, and will continue to have, the opposite effect, and Ohio will in the near future take high rank as a horticultural state.

W. J. Green.

OKLAHOMA, HORTICULTURAL POSSIBILITIES OF. Fig. 1519. The northern boundary of Oklahoma is 37° north latitude. The southern boundary is an irregular line, but does not extend far south of the 35th parallel. Except a small strip which extends to the 103d meridian, most of the territory lies between 96° 30′ west and 100° west longitude. The greater portion of the country has an altitude of 800 to 1,400 feet. The surface of the country is rolling prairie, with numerous small rivers and creeks flowing east. The longer streams are wide, shallow, and very sandy. The shorter streams are narrow and have high, steep banks. In the eastern half there are considerable areas covered with timber, the greater part of which is black-jack and post-oak. Elm, cottonwood, pecan, hickory, red cedar, walnut, hackberry and honey-locust are common, but do not form separate forests as the oaks do. In the western part timber belts follow the streams, and in the extreme western part only brush and small trees are found. The soil is usually a fine sand, the particles lying very compactly.



1519. Geographical features of Oklahoma.

Previous to the settlement of the country, in 1889, the prairies were burned off each year. This kept the soil poor in humus. There is very little clay soil in the territory except along the small streams, the bottomlands of which contain considerable clay. The soil is fertile and contains a good supply of plant-food. The subsoil is very compact, usually joint-clay, where the surface soil is a black or gray color; but the red or brown loam surface soil is usually underlaid with a more loose and mellow subsoil. The black and gray soils are usually found at greater altitudes, and are seldom covered with timber. Often these soils contain large quantities of alkali, and the well and spring water in such localities is very poor. Stone is abundant in some sections and very scarce in others, but there is not enough surface rock to be a factor in controlling the amount of tillable land. Red and gray sandstone are the most abundant.

The extremes of temperature between summer and winter are great. In some places the temperature reaches zero during the most severe storms of winter. Except during occasional storms, the winter is mild and usually dry. A snowfall of more than six inches in depth is rare, and soon melts. Plowing and other such farm work may be done nearly all winter. During the summer a maximum of 100° F. is frequently reached. The high temperature is nearly always accompanied by a dry wind. In the hottest weather the nights are cool and refreshing. The average mean temperature is about 60°. The wind is a prominent factor in the climate of Oklahoma. The prevailing wind is from the south during most of the year. The air is dry, and the wind and hot sun dry the soil rapidly. The rainfall usually is light during July and August, and the warm, dry winds from the south and southwest make this the most trying season for vegetation. The wind is so strong and constant that it does considerable damage to young trees and vines unless they are protected by some form of wind-break. Many snow and rain storms are accompanied by hard winds, which are seldom destructive.

The average annual rainfall for the territory is about 30 in. For the eastern half it is about 33 in., and gradually decreases to about 20 in. in the extreme western part. The rainfall for any one year varies greatly in different localities, and these areas of light and heavy precipitation are variable in size, shape and location from year to year. The line of average equal rainfall runs almost north and south, bearing to the west in the southern part of the territory. The winter and late summer are dry. Light snows fall during January, February and March, but usually melt in two or three days. Snow storms seldom reach the southern portion, and are light when they do. The rain and snow storms, almost without exception, travel from west and north to east and south. They travel very rapidly and last only a short time; the heaviest rains last only a few hours. Slow rains are rare, and come only during the colder part of the year. In 1897 there were about 250 days of sunshine, which is about the average. There is very little dark, foggy weather; and heavy dews, though common, are much lightened by the almost constant breeze.

The flora of Oklahoma may be said to be a mixture of the floras of Kansas and Texas, there being few species found here that are not found in one or both of these states. The predominance of yellow flowers is one of its most prominent characteristics. The botanical collections of the country are far from complete, but are complete enough to justify the statement that the flora is not a very extensive one. The number of perennial species is very small, and only a small portion of these are trees. The trees are usually low and much branched, and give a poor quality of lumber, which is, no doubt, partly due to the annual burning, and neither represents the quality or quantity of timber which the country is capable of producing when

protected from the fire. Wild fruit plants are abundant in nearly all parts of the territory, and usually bear moderately well. The plum, persimmon, grape, blackberry and dewberry are most common. With a reasonable amount of cultivation, most orchard fruits do well. Young orchards are beginning to bear in nearly all parts of the territory. These orchards contain only a short list of varieties, but most of these seem well adapted to the country. Most varieties show a strong tendency to early bearing. The fruit is of good form, size and quality, and promises to become one of the leading crops. See *Indian Territory*. O. M. Morris.

OKRA, or GUMBO (*Hibiscus esculentus*). Introduced into United States and West Indies from Africa, and cultivated for its fruit pods, which are used in soups, stews, catsups, etc. In soups and catsup, it gives body to the dish; stewed, it is mucilaginous, and while at first not agreeable to many people, a taste for it is easily acquired. It is also dried and canned for winter use. Sow in spring after the ground is thoroughly warmed, in good vegetable land. Make the rows 3 to 5 feet apart, according to variety, and drop seeds about 2 inches apart in the row; cover 1 or 2 inches deep. After plants are six inches high, thin to 1 foot apart for dwarf varieties and to about 3 feet for the largest varieties. The seedlings transplant with considerable difficulty, so they need to be started in flower-pots if an extra-early crop is desired. The pods must be gathered before the fiber develops in them: the size will vary with the variety, but if it is too "stringy" to cut with a dull case-knife it is too old. Keep all old pods cut off. The dwarf varieties are in greater favor in the South because of their habit of bearing early. A plant, constantly cropped, remains in bearing condition until frost kills it, but allowed to retain pods it suspends growth until the seeds have matured, when a second growth may take place. Okra will grow for years if not killed by frost or other adverse conditions, i. e., it makes an indeterminate growth like cotton, malva, hibiscus, etc. For shipping, cut the stems (peduncles) an inch or so long as to prevent wilting in transit. Pack firmly in vegetable crates. The demand for this vegetable is increasing, especially in New York City. Seed is easily grown and saved. The plant is subject to several diseases to such an extent that it is impracticable to raise a crop on certain pieces of land. Rotation is the best remedy.

P. H. Rolfs.

Okra is a half-hardy annual in the North, originally from Africa, introduced into the United States from the West Indies. It is cultivated for its young green pods, which are used in soups, stews and catsups, to impart a thick, viscous consistency, like tapioca or sago. When ripe, the black or brown white-eyed, globular seeds are sometimes roasted and used as a coffee substitute. Okra should be sown in a dry, warm soil, of medium fertility and texture, after danger of frost has passed. For an early crop the plants may be started in a hotbed four weeks earlier than sowings in the open ground. The seeds should be covered about an inch deep, 1–2 ft. asunder, and in rows 2–3½ ft. apart, according to the variety, whether dwarf or tall. In the South Okra is very generally cultivated; in the North it is almost unknown and only the dwarf varieties (Fig. 1520) succeed.

1520.
Dwarf Density Okra.
A small variety valuable for the North.

M. G. Kains.

OLD MAN. Another name for the Southernwood, *Artemisia Abrotanum;* also for the Rosemary, *Rosmarinus officinalis.*

OLD-MAN-AND-WOMAN, or common Houseleek. *Sempervivum tectorum.*

OLD MAN CACTUS. *Pilocereus senilis.*

OLD MAN'S BEARD. In Europe, *Clematis Vitalba;* in America our common Wild Clematis, *C. Virginiana;* also *Saxifraga sarmentosa:* rarely the Fringe Tree, Chionanthus.

ÔLEA (classical name for Olive). *Oleàceæ.* Olive. Between 30 and 40 trees or shrubs of the tropical and warm-temperate parts of the Old World to New Zealand. Lvs. evergreen and thick, opposite, usually entire, and often rusty-tomentose beneath: fls. small, usually imperfect, white or whitish, in forking panicles or fascicles, the short calyx 4-toothed (corolla sometimes none), the short-tubed corolla with 4 valvate lobes, the stamens 2: ovary 2-loculed, bearing a short style and capitate stigma: fr. an oblong or ovoid drupe. The best known species is **O. Europæa,** Linn. (see *Olive*). It is a small tree, rarely exceeding 20 or 25 ft. in height, and bearing small lanceolate lvs. and axillary forking racemes of yellowish white fragrant fls. It is probably native to the Mediterranean region. It has been in cultivation from the earliest times. **O. chrysophylla,** Lam., from tropical Africa, has been introduced by F. Franceschi, Santa Barbara. It is a small tree, noteworthy because of the golden color of the under surface of the lvs. The drupe is large and blackish: lvs. lanceolate, acute, entire, shining above. For *O. fragrans, illicifolia, Aquifolium,* and for garden treatment of the true Oleas, see *Osmanthus.*

L. H. B.

OLEANDER. See *Nerium Oleander.*

OLEÀRIA (derivation uncertain). *Compósitæ. O. Haastii* in New Zealand forms a small bushy tree of rounded form, with very stout branches densely clothed with deep green foliage and covered with numerous small white flowers. The genus is a very large one, and is confined to Australia and New Zealand, where many of the species are known as Daisy trees. *O. Haastii,* however, is far removed from our common idea of either a daisy or a composite. The heads are about three-eighths of an inch across, and look like an ordinary small 4-petaled white flower. They are borne in flattish branched clusters of a dozen or so. The rays vary from 3 to 5 in number, and the disk is reduced to 4–6 yellow fls. This rare plant is said to be hardy in eastern England. It was offered in America in 1899.

Olearia is a genus of 85 or more species. Shrubs, sometimes arborescent or suffrutescent, rarely branching herbs: lvs. alternate, rarely opposite, feather-veined or 1-nerved, entire or dentate: heads large, medium or small, solitary, corymbose or paniculed: rays white or blue: disk yellow or rarely purplish blue. For generic characters, see Flora Australiensis 3:463, where the genus is split into 5 sections.

Haástii, Hook. Lvs. ¾–1 in. long, elliptic or ovate-oblong, obtuse, short-petioled, very leathery, dark green above, white, but not shiny below. B.M. 6592. G.C. III. 20:533. Gn. 38, p. 149. F. 1874, p. 198. W. M.

OLEASTER. Popular name of *Elæagnus hortensis.*

OLERICULTURE. See *Vegetable Gardening.*

OLIVE. Figs. 1521, 1522. California is the principal state in the Union in which the Olive is grown, although there are portions of Arizona and New Mexico in which the climatic conditions are such that it is probable that the industry will in time become permanently established on a rather large scale.

The history of the Olive is of peculiar interest, not alone because it is so closely interwoven with the economics of the ancients, as well as with the daily life of the people in Asia Minor and in southern Europe, but because of the vicissitudes of cultivation, the difficulties to confront—not yet overcome—and the great possibilities for the culture of the fruit commercially. Botanically, the Olive is known as *Olea Europæa* (which see), belonging to the natural family Oleaceæ. Olea is a genus of trees and shrubs "having opposite, evergreen, leathery lvs., which are generally entire, smooth, and minutely scaly; small fls. in compound axillary racemes, or in thyrsi at the end of the twigs; a small 4-toothed calyx, a 4-cleft corolla, 2 stamens, a 2-cleft stigma: the fr. a drupe." It is a native of Syria and other Asiatic countries, and has for many centuries become naturalized in the south of Europe.

In the Mission San Diego, in the far southern part of California, were planted the first Olives, according to

the early historical accounts, which are more or less authentic. It is known that in 1769 sundry fruit and vegetable seeds were imported into California from Mexico by José de Galvez, and it is assumed that among them were seeds of the Olive, for in after years, as new missions were built, the Fathers planted Olive trees grown from cuttings taken from trees at the old San Diego Mission. Hence the name "Mission" by which this variety became known; and it was the only variety with which Californians were familiar until about 1880,

1521. Olive in flower and fruit.

after which time many trees were annually imported from Italy, Spain and France, though some were imported in smaller numbers previous to this time.

There is an immense area in California suited to the cultivation of the Olive, both as to climate and soil. It extends from the southernmost extremity to the foot of Mount Shasta, nearly 600 miles, and in width from the foot-hills of the Sierra Nevadas to the coast, varied according to soil and other local conditions. Theoretically this range is true, the Olive requiring a mean annual temperature of 57°, the mean for the coldest month to be 41°, and at no time must the temperature fall below 14°. But while the Olive will grow and bear fruit under these conditions, as with all other fruits there are certain peculiar localities where soil and climate combined are best adapted to its production in the greatest degree of excellence and in the most remunerative form. As with other fruits, there was formerly much misconception regarding the requirements of the Olive, which has resulted in a great deal of disappointment and pecuniary loss. Pessimists proclaimed that the culture of the Olive was a failure, that it "did not pay," but they forgot that lack of success might be due to errors in judgment on the part of the planter.

The Olive thrives best in a warm, dry atmosphere, where the soil is rich and well drained. However, it will grow and bear crops in a greater variety of soils than most trees. While the tree may live when the temperature falls to 14°, the chances are against it, and any frost during blossoming, or great heat or strong winds at this time or while the fruit is young, is likely to destroy prospects of a crop, or to materially diminish them. Because the Olive was said to be able to grow anywhere in California, and to prefer a rocky hillside, hundreds of thousands of trees have been planted in such uncongenial surroundings, which of itself is sufficient reason why the present crop returns do not at all come up to expectations according to the published estimate of acreage in trees compiled from the books of the county assessors. Such estimate shows the number of Olive trees in California to be nearly 3,000,000, but a large number of these trees are neglected, being unprofitable because planted where neither plant-food nor water is available in sufficient quantity. Many other groves were planted too near the coast, where the ocean fogs are prevalent during the summer months. This condition was not right, for while the trees would grow and bear crops, the fruit was not of the same quality as that produced under a sunny sky, and the trees suffered more from attacks of scale (Lecanium) in a foggy climate than in the warmer interior valleys.

The Olive grows to perfection in good soils throughout the length and breadth of the San Joaquin and Sacramento valleys; in many of the smaller Coast Range valleys, and up to an elevation of 1,000 feet or more in this range, and in the warm belt of the foot-hills of the Sierra Nevada mountains. As fine trees for their age and as fine fruit, either for oil or for pickling, may be seen as far north as Oroville and Palermo, in Butte county, and all through the northern Sacramento valley, as in the counties in the extreme south.

The Olive is propagated in various ways: from the seed, from tips, from long cuttings, from sprouts, suckers, and by layering. The seeds require some time to germinate, frequently two seasons, and the growth of the young plants is slow at first. This method, including the after-budding or grafting, is tedious, and therefore not popular, although a tree on a seedling root will be more robust and long-lived. Nurserymen usually adopt the "tip" system. "Tips" are small branches or ends, usually the laterals, taken from the tree when it is in its most dormant state, cut 4 or 5 inches long, the upper lvs. partially trimmed, while the lower ones are cut off close to the stem. These are then planted in a sand-bed or the propagating box until sufficiently well rooted to transplant to the nursery row. Many growers prefer to grow their trees from cuttings 14 inches long, made from 2- or 3-year-old wood, and up to 1½ inches in diameter.

The Olive requires irrigating to the same extent as other trees. In other words, if there is not sufficient moisture by rainfall, then water must be applied artificially. As it thrives best in the warmer regions of the state, where evaporation is very rapid, the inference must be that irrigation is generally necessary for the Olive. There is a saying in Italy, "No manure, no oil," which means that the Olive needs suitable food, and without water it cannot obtain it.

Almost every known variety has been imported into California, and, unfortunately, planted too extensively before it had been determined by experiment which was the better adapted to the varied, and to some extent foreign, conditions. Hence many orchards are unprofitable because the varieties planted, from whatever cause, do not bear crops in paying quantity. The "Mission" is still more largely planted than any other variety, as it seems more universally adaptive, and is valuable both for oil and for pickling. Some of the other varieties which are known to be good, and which may supersede the Mission, are, for oil, Atrorubens, Manzanillo, Nevadillo Blanco, Pendoulier, Precox, Razzo, Ruhra; for pickling, Ascolano, Lucques, Macrocarpa, Polymorpha, Regalis, Sevillano. Atroviolacea is valuable for drying, losing its bitter taste in the process; also the Sweet Olive, which has no bitterness.

For extracting the oil the same methods are employed which were in vogue thousands of years ago, with this difference, that the improved machinery of the present day with steam power reduces the question of labor to a minimum. It is essential that the Olives be perfectly ripe and sound; when picked they are spread upon trays piled one above the other, allowing for free circulation of air, until the water in them is mostly evaporated. Crushing is done under stone or iron rollers that are made to revolve in a large stone or iron basin in which about 350 pounds of Olives are placed. From this pulp the first or "virgin" oil is extracted by gentle pressure, the pomace is removed and again pressed to secure a second grade of oil, and sometimes a third grade is secured. The oil left still in the pomace is used by the soap-maker in the manufacture of Castile soap, and the residuum is valuable as a fertilizer. There are many details, all being important in themselves, absolute cleanliness and scrupulous care being observed in all the operations.

Pickling Olives is a simple matter in theory, but even more judgment is needed than in the oil-extracting process. The "bitter" is withdrawn by the use of lye, or else by long and daily immersions in fresh water. There is an increasing demand for Californian ripe pickled Olives, the crop invariably being sold before ready for delivery. In quality and flavor they are distinctly superior to the best imported green Olives. The most discouraging feature connected with the marketing of Olive oil is the fact that the imported oils are nearly all adulterated more or less either at foreign ports or in the United States, some showing 80 or 90 per cent of cottonseed. Until some national law is passed by which cottonseed oil shall be labeled and sold as such and not under names designed merely to deceive, such as "Pure Lucca Oil," "Pure California Oil," "Sweet Olive Oil," etc., the prospects for the California Olive-grower will not brighten as far as the production of oil is concerned. Given such a law, California can and will produce all the Olive oil that is needed in the United States.

See report on the Condition of Olive Culture in California by A. P. Hayne, Bull. 129 of Calif. Exp. Sta., issued May, 1900. LEONARD COATES.

OLIVE PRODUCTS.—Olives are almost entirely used for making oil and pickles; some varieties are prepared by simple drying, but the quantity so used in the U. S. is very small and need hardly be considered a market product as yet. The general use of Olive oil in this country has been somewhat retarded by the introduction and sale of refined (clarified) cottonseed oil under various names and brands as substitutes for the more expensive genuine oil. In some cases Olive oil is adulterated, to a greater or less degree, with the cheaper cottonseed oil, and sold as "pure Olive oil." This state of affairs is owing almost entirely to the fact that the general American public does not, as yet, appreciate the delicate flavor of a properly prepared pure Olive oil. At present the market demands that an oil must be clear and brilliant, without reference to its quality or flavor, and consequently even pure Olive oil is "clarified" and filtered until it loses its delicate and characteristic aroma. It is then no better than the cheaper cottonseed product with which it has to compete. But gradually the differences are being appreciated, and the demand for the true article is slowly but surely increasing.

Pickled ripe Olives have steadily grown in favor, and the more their value as a food material is appreciated the greater will be the demand for a properly prepared product. As yet little or no pickled green Olives are prepared in California. These do not serve as food, however, as do the ripe Olives, but merely as a relish, and must be considered as a delicacy rather than as a staple article of diet; hence their preparation can only be undertaken under special conditions, each manufacturer having his own particular process or recipe.

The manufacture of Olive oil, though apparently a simple process, requires the most painstaking care, and the closest attention to every detail, for the production of high-grade oil. To begin, the fruit must be carefully picked by hand, avoiding all unsound drupes, and handled as little as possible in order to avoid bruising. In some of the orchards in Europe the fruits are dropped into pails half filled with water, thus reducing to a minimum the danger of bruising. This is specially important when the Olives have to be kept for any length of time before crushing. It is by far the best plan to crush immediately, but this is not always possible. Then the Olives must be dried, and stored in layers not over three inches in depth, with a free circulation of air between the layers, in order to prevent molding or fermenting. In no case must unsound fruit be used, as even a few slightly moldy or fermented berries will impart a disagreeable odor and flavor to the entire product. When Olives have been frosted they must be picked and crushed immediately; a delay of twenty-four hours will render them unfit for use. The proper stage of ripeness is an important factor. The tendency is to allow the Olives to overripen. This is a mistake, as the quality of the oil is thereby deteriorated. Just after changing color has been found to be the proper stage for picking, for then the maximum oil-content and keeping qualities of the oil have been reached.

Various devices have been used for crushing. Formerly it was the practice to crush fruit and pits together between heavy millstones; but it has been found that the oil from the kernels not only imparts its characteristic flavor to the flesh oil, but also impairs its keeping qualities. At present crushers are used with the stones set far enough apart to avoid breaking the pits. Roller crushers are sometimes used, but these are, as a rule, objectionable on account of the liability of chemical action between the acids of the Olive juice and the iron, resulting in an inky color and taste. In Europe the

1522. California Olives, showing one method of pruning.

crushed pulp is pressed in special mats made of esparto grass, holding about twenty-five pounds each; but in California these mats have been found to be too expensive, and linen or sail-cloth has been successfully used instead. The best form of press is a screw-press, so arranged that the pressure is very gradual, and provided with a perforated steel basket (wood would not do on account of the absorbed oil becoming rancid), and all exposed cast-iron carefully covered with tin. The steel basket is filled with pulp in layers of about twenty-five pounds each, each layer being surrounded by cloth, and as much direct screw pressure as possible applied very gradually. After all the juice has run out, the resulting cakes of pulp are taken out, mixed with pure, cool water, and again pressed, this time as much as possible with the screw lever. This operation may be repeated a third and even a fourth time, the resulting oil being each time of inferior quality. In California, as a rule, but two pressings are made, forming first- and second-grade oil; in some cases the oils from the two pressings are mixed, and but one grade marketed. The oil can be recovered from the juice by simply allowing it to rise and accumulate on the surface, as it will naturally, being lighter than the watery juice. But this process is both slow and dangerous, because fermentation is liable to start in the juice, and greatly impair the quality of the oil. It thus becomes important to separate the oil as quickly as possible from the acrid juice. Several means have been devised for accomplishing this. The most satisfactory (of Italian invention), and one which has been tried at the California Experiment Station, is the washing out of the impurities by means of pure water. The apparatus consists of a tin tank about 4 feet high and 2 feet in diameter, provided with a perforated false bottom, below which a running stream of pure, cool water is admitted. Just above this false bottom a small stream of juice is run in. The water thus washes through the juice, the oil rising at once to the surface, passes through the long 4-foot column of water, and is thus freed from most of the vegetable matter, which falls to the bottom, where it is drawn off through an outlet provided for that purpose. The oil as it comes from this "separator," or the hand-skimmings from the surface of the juice, has still fine particles of pulp mixed with it, which impart a "prickly" taste, and it must be allowed to stand in a cool (about 50° F.) room until these impurities settle. It is then "racked" off, and can be sold as "new oil;" or again allowed to stand for further precipitation and racking until no more dregs are visible. This will give

a clear oil of the true Olive flavor and color. But the American market demands a perfectly clear and brilliant oil put up in glass, and this is usually obtained by filtering. This is detrimental to the flavor of the oil, for the more it is filtered the more neutral and "greasy" will the taste become. This practice, therefore, should be discouraged, and the desire for the true Olive flavor cultivated, making it impossible for cheap, neutral, greasy substitutes (such as cottonseed oil) to take its place in the taste of the consumer. Of the highest importance throughout the entire process is the item of cleanliness. The mill, press, floors, trays and all apparatus should be scalded daily—when in use—and no strong odor permitted about the premises; for so absorptive is pure Olive oil that it will immediately "take up" all unpleasant odors, and thus impair its delicate flavor.

For making pickles, no set rules can be laid down except to emphasize the importance of careful picking and handling (to avoid bruising) and cleanliness. Here, again, the Olives should not be allowed to overripen; if they are, they are likely to soften, and a first class pickle will be impossible. The Olives as they come from the trees contain a most acrid and bitter principle. This is extracted by means of pure water, changed daily, or by a weak solution of lye. The latter is almost universally used, though the water-extracted pickles are considered the best. The extreme length of time required (from 30 to 90 days), and the consequent danger from bacterial and fungoid contamination in the water process, renders its use impossible, except in special cases. For lye-extraction a solution containing from 1 to 2 per cent of lye is used, and the Olives allowed to stand in this until nearly all the bitter principle is extracted. Then they are soaked in pure fresh water (changed two or three times daily) until all the lye has been dissolved out. They are now ready for salting. This is done gradually, i. e., a start is made with a weak brine, and the strength gradually increased from time to time until it is strong enough to float an egg. This prevents shrinking and consequent toughening. The pickles are now ready for storing, and if properly prepared and put into boiled brine will keep for years. This is the process in outline; but in actual practice each detail will require modification brought about by varying conditions, and no "rule-of-thumb" can be laid down to suit all cases.

See Bulletins 104 and 123, and the annual reports of the California Experiment Station.

ARNOLD V. STUBENRAUCH.

OLIVE-BARK TREE. *Terminalia Catappa.*

OLIVE, WILD. *Oleu Europœa*; also *Elœagnus.*

OMPHALÒDES (Greek, *navel-shaped*; referring to the seeds) *Borraginàceæ.* NAVELWORT. Of this genus we cultivate 3 low-growing, hardy herbs, with fls. much like those of forget-me-not, but larger and usually with a white 5-pointed star dividing the corollalobes. The fls. are often more or less pinkish, particularly toward the center. They like moist situations, but in deep shade grow too luxuriantly; also the fls. are fewer and of a weaker blue. Partial shade or full sunlight is preferable. The commonest kind is the "Creeping Forget-me-not," *O. verna*, which is a spring-blooming perennial of easy culture, producing runners freely and easily prop. by division. It can be grown by the yard in a rockery and can be easily naturalized in wild, moist, half-shaded spots. It is also fine for fringing walks. It is said to like best a cool, moist loam, with a few bits of sandstone among which the roots may ramble and from which they may derive coolness and moisture. The choicest kind is *O. Lucilïæ*, also a spring-blooming perennial, but of tufted habit and impatient of division. It is a typical "uncertain" alpine: for some it flourishes like a weed; others have tried time and again to establish it permanently without success. It is a native of two localities in Asia Minor at a height of 8,000 ft., and grows in fissures of vertical cliffs. It is said to like a loose limestone soil, deep and well drained. When once established it self-sows. In America *O. Lucilïæ* has been successfully grown by J. B. Keller, but the plant is not now advertised in this country. *O. linifolia* is a summer-blooming annual of easy culture. *O. verna* has a white-fld. form, which is pretty but lacks the interest of a blue-fld. forget-me-not.

Omphalodes is a genus of about 10 species, native to the Mediterranean region, middle Asia and Japan. Annual or perennial herbs of low growth, glabrous or sparsely and minutely villous: root-lvs. long-stalked, lanceolate, ovate or cordate; stem-lvs. few, alternate: racemes lax, with or without a leafy bract at the base: calyx 5-parted; corolla-tube very short; lobes 5, imbricated, broad, obtuse; stamens 5, affixed to the tube, included: ovary 4-lobed. From Myosotis it differs in having depressed nutlets and nearly horizontal seeds, while in the forget-me-not genus the nutlets are ovoid, and the seeds erect. The descriptions given below are adapted from DeCandolle's Prodromus, vol. 10 (1846), with which the pictures cited agree rather poorly.

A. *Plant a summer-blooming annual.*

linifòlia, Mœnch. Erect, slightly glaucous, 1 ft. high: radical lvs. wedge-shaped; stem-lvs. linear-lanceolate, margin remotely ciliate: corolla twice as long as the calyx: nutlets dentate, inflexed at the margin. Dry, stony hills of Spain and Portugal. June–Sept. According to DeCandolle, the fls. are normally white, and it is var. **cærulèscens** which has bluish fls., sometimes tinged with rose. This belongs to a group in which the nutlets are affixed laterally and lengthwise to the style, which is pyramidal and has a square base.

AA. *Plants spring-blooming perennials.*

B. *Habit creeping by runners.*

vèrna, Mœnch. CREEPING FORGET-ME-NOT. Stoloniferous: flowering-stem erect: lvs. sparsely puberulous; radical ones long-petioled, ovate or subcordate; stem-lvs. short-petioled, sublanceolate; all lvs. acuminate, callous at the apex: fls. borne in pairs in a raceme. April, May. Eu. B.M. 7 (*Cynoglossum Omphalodes*). Gn. 26, p. 315; 40:818.—Flowers light blue, according to DeCandolle. Var. **álba** is also offered.

BB. *Habit tufted, not creeping.*

Lucilïæ, Boiss. Glabrous, tufted: lvs. oblong, obtuse, the radical lvs. narrowed into a long petiole, the stem-lvs. sessile, upper ones ovate: pedicels longer than the nearest floral leaf, erect, then arcuate-recurved: fls. blue; calyx-lobes ovate-oblong, somewhat obtuse, about one-fourth as long as the pedicels; corolla broadly funnel-shaped, about four times as long as the calyx: nutlets with an entire membranaceous margin. Mt. Sypilus near Manesis, and in Cilicia near Gulf of Scanderoon, at 8,000 ft. B.M. 6047 (some fls. light blue, others pinkish purple, all with a white eye). Gn. 27:482; p. 194.—This and *O. verna* belong to a group in which the nutlets are depressed, shorter than the persistent style, scarcely adhering to it at the base, and smaller than the calyx, to which it is adnate. Fls. about ½ in. across, twice as large as those of *O. verna.* W. M.

ONCÍDIUM (Greek, *a tubercle*; alluding to the crest on the labellum). *Orchidàceæ.* A large genus of orchids with over 300 species distributed in Mexico, Central and tropical America, and in the West Indies. In range of altitude the genus extends from the hot coast regions to elevations of 12,000 ft. in the Andes. The fls. of this genus show a remarkable diversity of form. In *O. varicosum*, *O. tigrinum* and related species, the labellum is greatly developed, forming the most conspicuous part of the flower, while in *O. serratum* and *O. macranthum* it is inconspicuous. The sepals and petals vary in size in relation to each other and to the rest of the flower. A remarkable instance is *O. Papilio*, in which the petals and dorsal sepal have been transformed into linear-erect segments, recalling, on a large scale, the antennæ of some insect. The general habit of the plants is no less variable than the fls. They range in size from small, erect forms scarcely 6 inches in height (*O. pumilum*) to those resembling *O. altissimum*, with immense climbing panicles 9 to 12 ft. high, and covered with numerous medium-sized fls. The prevailing color of the fls. is yellow, spotted and barred with brown. White or rose-colored fls. occur in a few rare instances (*O. incurvum*, *O. ornithorhynchum*).

Pseudobulbs usually present, wanting in a few species, 1–2-lvd., with sheathing lvs. at the base: lvs. plane, terete or triangular: petals like the dorsal sepal but often much larger; lateral sepals either free or partially united; labellum variable, but never with its base parallel to the column (Odontoglossum), spreading nearly at right angles to the column: column short, winged.

As a class, Oncidiums are short-lived under cultivation. Few growers succeed in maintaining them in good condition for any great length of time. The stock is constantly renewed from the tropics.

HEINRICH HASSELBRING.

The genus Oncidium embraces a great number of species which are found growing under such peculiar and varied conditions in their native homes that imitation of the same is usually impracticable and often quite impossible. A fair degree of success, however, may be obtained by careful observation and distribution of the exceptionally difficult species among the several orchid departments.

The Sarcoptera section, which embraces such species as *O. Cavendishianum*, *O. Lanceanum*, *O. luridum*, *O.*

1523. Oncidium serratum (×⅓).

pulvinatum and others of similar structure, and the *O. Papilio* section, with *O. ampliatum*, may be successfully grown in a bright, warm portion of the Cattleya department in small baskets suspended from the roof, using for a compost a mixture of clean chopped peat and sphagnum moss, freely interspersed with lumps of broken charcoal.

O. cucullatum, *O. incurvum*, *O. macranthum*, *O. ornithorhynchum*, *O. Phalænopsis*, *O. varicosum*, with a few others of like nature, do well under treatment similar to that given for Odontoglossums, which see.

When a large collection of species is cultivated, a majority, including many of the above, can be readily grown in one house if it be especially adapted to them. Such a house should be a span-roof structure of east and west exposure, at an angle of about 40°, which will admit the longest possible light. The early morning and late afternoon sun striking the glass at right angles produces and prolongs the natural sun heat for a greater portion of the day, while at midday, when the outside temperature is highest, the sun's rays strike the glass obliquely, giving less heat, with little danger of the plants becoming sunburned from lenses in the glass. Oncidiums require more sun and air than most orchids.

The benches may be of either wood or stone, and should be covered an inch or two in depth with sand, ashes or gravel. The benches and paths should be wet down once or twice daily to insure a moist atmosphere. Ventilators should be arranged on both sides of the roof: air may then be freely admitted without causing direct drafts on the plants by using the ventilators on the sheltered side. In winter the temperature should range from 50° to 55° F. at night and 60° to 65° by day, or a few degrees more with sun heat and ventilation. In summer it must be kept as low as outside conditions will permit. From March until October shading must be applied to the glass sufficiently heavy to keep down the temperature without excluding indirect solar influence. A good shading is made of turpentine and white lead; it stands well and is easily removed. It can be applied rapidly with a whitewash brush on a long pole, and removed with a hard brush in the fall.

Oncidiums may be grown in either pots or baskets, but as many species are of rambling habit, the latter are preferable. The tiny species, such as *O. Limminghii*, do best on blocks with little compost beneath them. Clean chopped peat fiber and live sphagnum moss, equal parts, make the best general growing material, and this should be liberally interspersed with broken pieces of charcoal. The plants in all cases must be securely fastened, and the compost must be pressed in moderately firm, but should be used sparingly. Overhead syringing should be given frequently, once or twice a day in bright weather, but care must be taken not to keep the compost too wet, or the roots are liable to decay: it is advisable to let them dry out occasionally.

Stock is increased by division or notching the rhizome between the pseudobulbs just before the growing season, allowing three or four pseudobulbs to each piece and separating the parts after the first growth is matured.

For other cultural notes on the genus, see Veitch's Man. of Orch. Plants, vol. 2, Section Oncidium, page 5; Orchid Review 1:296, and Nicholson's Dict. of Gard. 2:483.

ROBERT M. GREY.

Owing to the wide geographical distribution of the Oncidiums, it is almost impossible to give any general cultural directions for the whole group. We find that the greater bulk of the Oncidiums succeeds admirably in a Cattleya house, and by placing such varieties as enjoy more heat and moisture in the warmest part of the house, the balance of the Oncidiums are comparatively easy to take care of in any part of the structure wherever light, air and moisture are maintained. The following are a few enjoying more heat than the others: *Oncidium ampliatum*, *O. bicallosum*, *O. Carthaginense*, *O. Cavendishianum*, *O. Lanceanum* and *O. luridum*.

Oncidium varicosum, the most popular and most useful of all the Oncidiums, delights in a position close to the glass, especially under the ridge of the house, where it receives an abundance of light and air, and in such a position this plant will grow well and flower profusely. *Oncidium Papilio* and *O. Krameriauum* do best grown in baskets or on blocks and kept rather dry.

The following thrive well in a cool house, such as an Odontoglossum house: *Oncidium macranthum*, *O. ornithorhynchum*, *O. incurvum*, *O. tigrinum* and *O. cucullatum*. The first mentioned is one of the most beautiful of the entire genus, but being a plant very difficult to import, very few are seen in collections in this country. It occurs at a very high elevation in the Cordilleras of Ecuador.

Oncidium cucullatum is another plant which is difficult to grow successfully here on account of our hot summers. It occurs in several places in the Colombian Cordilleras, but always at a very high elevation. With these few exceptions mentioned, the greater part of the Oncidiums will succeed in a Cattleya house. Indeed, most of the species are found in the Cattleya and Lælia

regions under more or less similar conditions. A temperature of 55° to 60° at night, and correspondingly higher during the day, will suit most species. An abundant supply of air and light, though in partial shade, is indispensable. Water must be used freely during the growing season and somewhat reduced during their respective resting seasons. An occasional dipping in manure water (either cow or sheep manure) will greatly assist these plants in bringing to perfection their flower-spikes, which are oftentimes very large. In a good many species the flower-spikes are out of all proportion to the size of the plants, and unless they are assisted as indicated, they will very soon run out.

For potting, use very soft fibrous peat, with a sprinkling of live sphagnum. Pot firmly, or the plants will be very slow in taking hold. JOHN E. LAGER.

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SYNOPSIS OF SECTIONS.

A. *Leaves plane, not terete.*
B. *Labellum smaller than the sepals and petals*.....Species 1–5
BB. *Labellum at least as large as the other segments, often greatly exceeding them.*
C. *Lateral sepals more or less united at base.*
.....Species 6–18
CC. *Lateral sepals free.*
D. *All the segments having a distinct blade, none of them linear-subterete.*
E. *Pseudobulbs present*.....Species 19–37
EE. *Pseudobulbs wanting or obsolete*...Species 38–44
DD. *Only lateral sepals with distinct blade: dorsal sepal and petals elongate, linear, erect, with an obsolete blade*....Species 45–46
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AAA. *Lvs. subtriangular in section*.....Species 49

DESCRIPTION OF SPECIES.

A. *Lateral sepals united at base*..1. **micropogon**
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B. *Sepals and petals linear, flaccid*.....2. **phymatochilum**
BB. *Sepals and petals broad, serrate*.....3. **serratum**
BBB. *Sepals and petals broad, entire or subentire.*
C. *Fls. brown*.....4. **superbiens**
CC. *Fls. yellow*.....5. **macranthum**

1. **micropogon**, Reichb f. Pseudobulbs almost in 2 rows on the rhizome, broadly ovoid: lvs. 4–6 in. long, linear-oblong, rounded at the top, leathery: raceme 8–10 in. long, on a long stalk, flexuous, pendulous: fls. 1½ in. across; sepals linear-oblong, undulate, yellow, barred with brown; petals clawed, orbicular, yellow, with a deep red-brown claw; labellum yellow, smaller than the petals, having 3 almost equal, rounded, clawed lobes. Aug. Trop. Amer. B.M. 6971.—Var. **supérbum**, Hort., is advertised.

2. **phymatochilum**, Lindl. Pseudobulbs broadly fusiform, 4–5 in. long, purplish brown, with several large scales at the base: lvs. membranous, oblanceolate, 12–14 in. long: scape rather slender, over 1 ft. long, with a pendent panicle more than a foot long: sepals and petals linear-subulate, flaccid and somewhat twisted, greenish yellow, with deep orange blotches; labellum shorter than the sepals, white, with a yellow and orange crest; the middle lobe triangular-ovate, acuminate. Brazil. B.M. 5214. F.S. 23:2465. G.C. 1848:139.

3. **serràtum**, Lindl. Fig. 1523. Pseudobulbs 4–6 in. long, partly enclosed by sheathing lvs., 1–2-lvd.: lvs. about 1 ft. long and 2 in. broad: inflorescence a long, twining, loosely-branched panicle, 6–10 ft. long: fls. numerous, 3 in. across; upper sepals broad, reniform, the lateral ones very much longer, obovate, all chocolate-brown, with yellow tips and margins, strongly undulate, serrate; petals shorter, oblong, wavy and curled so that they almost meet over the column, yellow with brown spots, margins serrate; labellum small, hastate, fleshy, with a crest of 5 ridges. Winter. Peru. B.M. 5632. F.S. 6, p. 167.

4. **supérbiens**, Reichb. f. Pseudobulbs 3–4 in. long, ovate to ovate-lanceolate, much flattened: lvs. linear, 14 in. long and 1¼–1½ in. broad, some sheathing the pseudobulb: panicle 2–3 ft. long, loosely branched and flexuous, bearing 20–30 fls. each 2½ in. in diam.: sepals long-clawed, undulate, chocolate-brown with yellow tips; the upper one trowel-shaped, with a cordate base, the lower pair more ovate; petals rather smaller, with shorter, broader claws, much recurved and wavy, yellow with brown bars; labellum less than half as large as the sepals, revolute, trowel-shaped, with auriculate side lobes, brown with a yellow crest. Spring. Venezuela, Colombia. B.M. 5980.

5. **macránthum**, Lindl. (*O. hastiferum*, Hort.). Pseudobulbs ovoid or flask-shaped, 3 in. long: lvs. narrowly lanceolate, acuminate, 1 ft. long: panicle climbing, loosely branched and many-fld.: fls. 3–4 in. across; sepals rounded-oblong, with green claws, the upper one yellowish brown, the lower pair orange-yellow; petals similar, golden yellow, streaked with blood-red at the base; labellum small, hastate, purple-brown, with a prominent white crest. Spring and summer. Cent. Amer. B.M. 5743. Gn. 24:416. F. 1871, p. 187. J.H. III. 34:337.—A magnificent orchid, of which there are several varieties, some of secondary merit.

A. *Petals clawed, with a broad, obovate or rounded blade, not much smaller than the labellum.*
B. *Fls. yellow; column wings short, quadrate*.....6. **Marshallianum**
BB. *Fls. red-brown: column wings narrow, angular*.....7. **Forbesii**
BBB. *Fls. dull brown, with yellow markings.*
C. *Column wings small, truncate*. 8. **curtum**
CC. *Column wings large, sharply serrate*.....9. **crispum**
AA. *Petals and dorsal sepals obovate, cucullate, not clawed*..10. **cornigerum**
AAA. *Petals and dorsal sepals subsimilar, very small: labellum larger than the rest of the flower.*
BB. *Labellum white, spotted with rose-purple*.....11. **cucullatum**
BB. *Labellum yellow.*
C. *Blade bifid*.....12. **Martianum**
13. **flexuosum**
CC. *Blade quadrifid*.....14. **varicosum**
AAAA. *Petals and sepals lanceolate, ovate, etc., at least one-half as long as the labellum and of a different form.*
B. *Fls. white, spotted with purple*.15. **Phalænopsis**
BB. *Fls. yellow or greenish, spotted and barred with brown.*
C. *Crest serrate*.....16. **longipes**
CC. *Crest a smooth, heart-shaped callus*.....17. **dasystyle**
BBB. *Fls. entirely yellow*.....18. **concolor**

6. **Marshallianum,** Reichb. f. Pseudobulbs ovoid, 2–4 in. long: lvs. narrowly oblong, 6–8 in. long: fls. numerous, 2½ in. across, borne on a stout panicle 1–2 ft. high; the upper sepals oblong-apiculate, the lateral ones united, yellow, with purplish bands; petals much larger, fiddle-shaped, wavy and 2-lobed, golden yellow, with few blotches of chocolate-brown; labellum with a very large spreading 2-lobed middle lobe and ear-like side lobes, yellow, with orange-red spots on the base. May. Brazil. B.M. 5725. F.M. 1877:285.—A very effective and showy plant related to *O. crispum*.

7. **Fórbesii,** Hook. Pseudobulbs rather small, oblong, compressed and sulcate: lvs. lanceolate, dark green, 9 in. long: panicle about 1 ft. high, bearing numerous handsome fls. 2 in. across: fls. rich reddish brown, margined with yellow; sepals small, obovate; petals twice as large, obovate-rotund; side lobes of the labellum small; middle lobe spreading, fan-shaped. Autumn. Brazil. B.M. 3705. G.C. II. 11:525.—A rare but very ornamental orchid.

8. **cúrtum,** Lindl. Lvs. and pseudobulbs like those of *O. crispum*: inflorescence an erect, much-branched pyramidal panicle: fls. 1–1½ in. across: lateral sepals united, rather small; dorsal sepals and petals obovate-obtuse, yellow, with reddish brown bars and blotches; labellum with small lateral lobes and a roundish, notched middle lobe, yellow bordered with brown; crest lobed and warted, yellow, with red spots. Brazil. B.R. 33:68. (in. 10, p. 131; 31, p. 198; 34, p. 87.—Blossoms in spring, the flowers remaining fresh for several weeks.

9. **crispum,** Lodd. Pseudobulbs oblong, sulcate, rough and usually dark brown: lvs. leathery, lanceolate, about 9 in. long: flower-stem 1–1½ ft. high, arched, bearing 20–50 large fls. 1½–3 in. across: fls. shining brown, with few yellow and red marks at the bases of the segments; sepals obovate, obtuse, recurved and undulate, the lateral ones united; petals twice as large, broadly obovate, obtuse, much waved and crisped; middle lobe of the labellum large, rotund-cordate, waved and crisped; lateral lobes small, horn-like. Fls. at various seasons. Brazil. B.M. 3499. B.R. 23:1920. L.B.C. 19:1854. F.S. 21:2147–48. F.C. 2:64. B. 1:26.—Var. **grandiflórum,** Hort. Fls. very large, the segments edged with yellow.

10. **cornígerum,** Lindl. Pseudobulbs oblong, sulcate, 3 in. long, 1-lvd.: lvs. dark green, broadly ovate to oblong, fleshy, ribbed, 4 in. long: panicle about 18 in. long, drooping, branched and crowded with fls. above: fls. small but numerous, yellow, spotted with red; dorsal sepals and petals obovate, concave, undulate, the lateral sepals smaller and united; labellum with long-linear lateral lobes and 2 horn-like processes at the base; middle lobe obovate, subrepand. April, May. Brazil. B.M. 3486. B.R. 18:1542.—A compact free-flowering plant which is very attractive when grown in baskets so that the long racemes can hang over the sides.

11. **cucullátum,** Lindl. Pseudobulbs oval, 1½ in. long, smooth, becoming ribbed: lvs. oblong-lanceolate, 6 in. long: raceme almost simple, 8–12 in. long, bearing 6–12 fls. 1¼ in. across: dorsal sepals and petals small, oval, greenish, shaded with rose-purple; lateral sepals almost entirely united; labellum cordate-panduriform, with the middle lobe much dilated and 2-lobed, white to rose and spotted with dark purple. Spring. Colombia. F.S. 8:835; 23:2457. I.H. 25:305. Gn. 22:350 (var. *gigantéum*).—A species with many varieties, which differ in shape and coloring of the fls. It is one of the coolest of the Andean orchids. Var. **nubígenum,** Lindl. Raceme suberect: sepals and petals white or light purple, with green tips; labellum white, with a purple blotch around the crest. B.M. 5708.

12. **Martiánum,** Lindl. (*O. bicolor*, Lindl.). Pseudobulbs ovate, compressed and ribbed: lvs. oblong, striate: fls. yellow, spotted; lateral sepals united, ovate, acute; petals obovate, concave; middle lobe of the labellum larger than the rest of the flower, 2-parted by the deep sinus in front, clear yellow. Autumn. Brazil. B.R. 29:66.—A beautiful yellow species, with a panicle 2 ft. high.

13. **flexuósum,** Sims. Pseudobulbs ovate, flattened, 2 in. long: lvs. linear-oblong, 6 in. long: fls. scarcely 1 in. across; sepals and petals small, recurved, yellow, with chestnut bars; labellum yellow, with few reddish spots; side lobes small; middle lobe reniform, notched. Brazil. B.M. 2203. L.B.C. 5:424.—The plant blooms freely at various seasons. The fls. open in succession on a loose spreading panicle about 2 ft. high.

14. **varicósum,** Lindl. Pseudobulbs ovate, angled, 2–4 in. long: lvs. rigid, linear-lanceolate, 9 in. long: fl.-spikes strong, arching, 3 ft. long, with numerous fls. 1 in. across: sepals and petals small, green, with brownish blotches; labellum very large in proportion to the flower, bright yellow, with a curiously toothed crest;

1524. Oncidium varicosum, var. Rogersii (× ⅓).

lateral lobes rotund; middle lobe reniform, obscurely 4-lobed. Winter and spring. Brazil.—One of the most attractive. Var. **Rógersii,** Reichb. f. (*O. Rödgersii*, Hort.). Fig. 1524. The best variety. Specimens have borne 150 fls., with the lip over 2 in. across, rich yellow, with a few red bars at base. G.C. 1870:277. F.S. 18, p. 150. F. 1870:25. Gn. 55:1226. G.M. 39:366.

15. **Phalænópsis,** Linden & Reichb. f. A small-growing plant, with pseudobulbs oblong, somewhat ribbed, 1–2 in. high: lvs. narrow at the base, broadening upward, about 6 in. long: fls. 3–6 on a slender raceme, gaily colored, creamy white, with the sepals and petals barred with reddish purple, and the base of the lip profusely spotted with the same color; sepals and petals quite similar, oblong, acute; labellum pandurate, with 2 rounded lobes in front. Blooms at various seasons, and lasts a long time. Ecuador. I.H. 17:3. Gn. 41:859. J.H. III. 28:515.—A beautiful little plant, worthy of extended cultivation. Much like *O. cucullatum*.

16. **lóngipes,** Lindl. (*O. Jancirénse*, Reichb. f.). Pseudobulbs narrowly ovate, 2-lvd.: lvs. narrow: scape several-fld., equaling the lvs.: fls. on long pedicels; lateral sepals elongate, pendulous, united at the base; dorsal sepals shorter and wider, recurved; petals oblong, plane; all yellowish green, barred with brown; labellum yellow, spotted with brown at the base; lateral lobes small, obtuse; middle lobe transversely broadened, apiculate, the narrow part serrated. Summer. Brazil. I.H. 2:54. B.M. 5193, called *O. longipes*, is *O. Cœsus*, Reichb. f.—A small species.

17. **dasýstyle,** Reichb. f. Pseudobulbs ovate, flattened, strongly rugose: lvs. 4–5 in. long, linear-lanceo-

late: scape very slender, 6–7 in. long, bearing 2–5 fls., each 1½ in. across: dorsal sepals and petals subequal, lanceolate, pale yellow, blotched with purple-brown; lateral sepals larger, united half-way; labellum large, sulfur-yellow, with a blackish purple callus; lateral lobes small, triangular; middle lobe round fan-shaped membranous and undulate. Jan., Feb. Organ Mts., Brazil. B.M. 6494.

18. **cóncolor,** Hook. (*O. unguiculàtum,* Klotzsch). Pseudobulbs small, oval-oblong, slightly furrowed; lvs. lanceolate: fls. 1–2 in. in diam., rich yellow, borne on pendulous racemes 1–2 ft. long; lateral lobes united for half their length, smaller than the dorsal sepals and petals, which are obovate; labellum twice as long as the sepals, broad, flat, bilobed, with 2 reddish ridges running down on the base. April–June. Organ Mts. B.M. 3752. I.H. 30:487. R.H. 1881:30. Gn. 13:III.—A plant of close and compact habit, making one of the most attractive yellow coolhouse orchids.

A. *Labellum with a large reniform mid-lobe; lateral lobes small or none.*
B. *Petals much broader than the sepals* ..... 19. **ampliatum**
20. **excavatum**
BB. *Petals and sepals nearly of the same size.*
C. *Fls. over 2 in. across: labellum large, forming the most conspicuous part of the flower: panicle stout*..... 21. **tigrinum**
22. **splendidum**
CC. *Fls. medium-sized, numerous, in long, climbing panicles.*
D. *Sepals and petals linear-lanceolate, acute.*
E. *Fls. white and purple*..... 23. **incurvum**
EE. *Fls. yellow and brown.*
F. *Column wings very truncate: crest of several interrupted ridges* ..... 24. **Baueri**
FF. *Column wings rounded, slightly crenulate*..... 25. **altissimum**
FFF. *Column wings erose, sphacelate*..... 26. **sphacelatum**
FFFF. *Column wings falcate, dentate*..... 27. **reflexum**
DD. *Sepals lanceolate: petals spatulate* ..... 28. **Batemannianum**
DDD. *Sepals and petals linear to oblong, obtuse.*
E. *Color of labellum yellow*.... 29. **Harrisonianum**
EE. *Color of labellum white*..... 30. **leucochilum**
AA. *Labellum with the middle lobe variously shaped, rarely reniform, but more so than the lateral lobes, large.*
B. *Fls. rose-colored*..... 31. **ornithorhynchum**
BB. *Fls. yellow, variously marked and spotted.*
C. *Crest pulvinate, pubescent*.. 32. **divaricatum**
33. **pulvinatum**
CC. *Crest not pulvinate.*
D. *Apex of labellum deeply 2-lobed* ..... 34. **Warneri**
DD. *Apex of labellum apiculate, lateral lobes tooth-like*..... 35. **maculatum**
DDD. *Apex of labellum merely emarginate, lateral lobes large.*
E. *Middle lobe broadly reniform, clawed*..... 36. **Limminghii**
EE. *Middle lobe not clawed, separated from the lateral lobes merely by a sharp constriction*..... 37. **cheirophorum**

19. **ampliàtum,** Lindl. Pseudobulbs subrotund, compressed, bright green with purple spots, becoming blackish purple and wrinkled with age: lvs. plane, oblong-lanceolate, 9 in. long: inflorescence a large panicle 1–3 ft. long, with numerous fls., which are yellow, spotted with red at the bases of the segments; sepals and petals small, the former entirely free; labellum reniform, spreading, wavy, 1½ in. across, narrow at the base, with two small lateral lobes and a prominent lobed crest. March–May. Throughout the coast of Nicaragua. B.R. 20:1699.—The flowers are produced in magnificent panicles. In var. **május,** Hort., they are half again as large as in the type. F.S. 20:2140. G.C. III. 17:173. Gn. 45, p. 491. G.M. 37:475.

1525. Oncidium tigrinum (O. Barkeri), to show habit.

20. **excavàtum,** Lindl. (*O. aurôsum,* Reichb. f. & Warsz.). Pseudobulbs oblong, compressed, 3–5 in. long: lvs. 1½ ft. long, leathery, shining green: panicle 3–5 ft. long, with numerous fls. 1½ in. across, yellow, spotted with brown: sepals obovate, obtuse, free; petals oblong, retuse; labellum sessile, with several broken ridges near the base, pandurate, excavated on the under side; middle lobe rotund, emarginate. Autumn. Peru. B.M. 5293. I.H. 17:34.—Strong plants produce as many as 100 flowers on each panicle.

21. **tigrinum,** LaLlave & Lex. (*O. Bárkeri,* Lindl. *O. unguiculàtum,* Lindl.). Fig. 1525. Pseudobulbs oval, compressed, 2-lvd.: lvs. oblong-lanceolate, thick, 1 ft. long: panicle erect, stout, 3 ft. high: fls. 2½ in. across; sepals and petals similar, lanceolate, undulate, rich reddish brown, with few bars and spots of yellow; labellum yellow, with a very large, orbicular-reniform blade supported on a long claw, lateral lobes oblong. Winter. Mex. I.H. 1:2; 22:221. P.M. 14:97. R.H. 1889, p. 176.—Very much like *O. splendidum,* from which it differs by the longer claw of the labellum having a thick keel, and the oblong lateral lobes of the labellum. Both are among the most showy Oncidiums in cultivation. Var. **grandiflòrum,** Hort., is advertised.

22. **splèndidum,** A. Rich. Pseudobulbs small, round, compressed, 1-lvd.: lvs. leathery, oblong-ovate, 6–12 in. long: fl.-stalk erect, 2 ft. long: fls. 3 in. across; sepals and petals similar, lance-oblong, acute, recurved, yellow-green, with broad brown bands; labellum very large, yellow, the broad claw of the middle lobe expanding into a large reniform blade; lateral lobes small, rotund. Spring. Guatemala and Mex. B.M. 5878 as (*O. tigrinum,* var. *splendidum*). F.S. 18:1825. Gn. 51:1121. R.B. 17:108. G.C. 1871:42; III. 3:108.

23. **incúrvum,** Barker. Pseudobulbs ovate, compressed and ribbed, 2 in. long: lvs. 9 in. long, ensiform, acute: panicle 2–3 ft. long, slender, much branched and gracefully arched: fls. 1½ in. across, numerous; sepals and petals linear-lanceolate, undulate, white, banded with purple; labellum white, with a purple blotch; lateral lobes rotund, small; middle lobe subreniform, concave. Bears numerous panicles in autumn. Mex. B.M. 4824. B.R. 31:64. I.H. 2:49; 29:444 (white variety).

24. **Baùeri,** Lindl. (*O. altissimum,* Lindl.). Pseudobulbs oblong, compressed: lvs. ensiform, rigid, keeled: panicle with numerous branches and rather dingy fls.: sepals and petals about as long as the labellum, linear-lanceolate, undulate, yellow, with red spots; labellum with 2 spreading lateral lobes and a reniform emarginate mid-lobe, yellow, with a reddish band. Trop. Amer. B.R. 19:1651 (as *O. altissimum*).—A gigantic epiphyte

with flower-stems 6–9 ft. long and "lvs. as long." It has been confused with *O. altissimum*.

25. **altissimum,** Swartz. Pseudobulbs nearly rotund, much compressed and edged: lvs. 1–2 at the top and several at the base of the pseudobulb, ensiform, keeled, 1½–2 ft. long: inflorescence an almost simple, drooping raceme, 4–6 ft. long: sepals and petals free, similar, spreading, linear-lanceolate, undulate, pale yellow, with olive-brown blotches; labellum nearly as long as the petals, fiddle-shaped, with the middle lobe reniform, spreading, yellow, with a brown band near the center, prominently crested. Aug. W. Indies. B.M. 2990. B.R. 22:1851.

26. **sphacelàtum,** Lindl. Pseudobulbs elongate-ovate, compressed: lvs. long, ensiform, apex recurved: scape strict, bearing a many-fld. panicle: sepals and petals linear-lanceolate, undulate, yellow, spotted with brown; labellum about as long as the sepals; lateral lobes auriculate; middle lobe with 2 rotund lobes, yellow, with brown spots at the base. Spring. Honduras. B.R. 28:30.—Var. **grandiflòrum,** Hort., is a better variety.

27. **refléxum,** Lindl. Pseudobulbs ovate, 1-lvd.: lvs. narrowly lanceolate, acute: panicle with its stalk 3–4 ft. long, pendulous: sepals and petals linear-lanceolate, undulate and reflexed, yellowish, shaded with pale brown; labellum with a large, reniform, emarginate middle lobe and rotund lateral lobes, yellow, with few reddish spots on the base. Mex. B. 3:116.

28. **Batemannìanum,** Parmentier. Pseudobulbs large, 4–5 in. long, with sheathing lvs. at the base: lvs. oblong-ensiform, 2 ft. long: scape erect, 6–8 ft. long: sepals lanceolate, undulate, reddish brown, slightly marked with yellow; petals similarly colored, spatulate and very much undulate; labellum brilliant yellow, with the crest marked with brown; lateral lobes small, rounded; middle lobe large, reniform, emarginate. Brazil. F.C. 3:137.—Related to *O. altissimum*.

1526. Oncidium ornithorhynchum (× ¼).

29. **Harrisonìanum,** Lindl. (*O. Harrisiànum,* Hort.). Pseudobulbs subglobose, 1-lvd.: lvs. linear-oblong, acute, fleshy and recurved: panicle about a foot high, erect, with the stem and branches gracefully curved: sepals and petals linear, obtuse, yellow, spotted with purple-brown; labellum yellow, longer than the sepals, with small lateral lobes and a subreniform, emarginate middle lobe. Autumn. Brazil. B.R. 19:1569. L.B.C. 20:1917. R.B. 18:253.

30. **leucochìlum,** Batem. Pseudobulbs sulcate, ovate, compressed, 2–4 in. long: lvs. sword-shaped, 1 ft. or more in length: scape 3–4 ft. high, with numerous branches on which the fls. are loosely scattered: sepals and petals oblong, obtuse, green, blotched with reddish brown; labellum pure white; lateral lobes small, rounded; middle lobe broadly reniform, emarginate. Autumn. Guatemala. Batem. 1. F.S. 5:522. P.M. 7:241.—A noble species, with the habit of *O. Baueri*. Panicles 6–9 ft. long. Var. **splèndens** is listed.

31. **ornithorhỳnchum,** HBK. Fig. 1526. Pseudobulbs oblong, compressed, 2–3 in. long, 2–3-lvd.: lvs. grass-like, 8–12 in. long: stalks 1 ft. long, slender and arched, many-fld.: fls. scarcely 1 in. across, soft rose-purple; sepals linear-oblong, wavy; petals oblong and a little broader; labellum pandurate, with small lateral lobes and a larger dilated, emarginate middle lobe. Fragrant. Autumn and winter. Mex. B.M. 3912. B.R. 26:10. F.C. 3:136. R.H. 1876:230.—This is an easily grown, free-flowering plant of dwarf, compact habit. Its soft rose-purple color is very delicate and unusual in the genus. Var. **albiflòrum,** Reichb. f. (var. *álbum,* Hort.). Fls. whitish, with only the calli yellow. F.M. 188:398. G.C. III. 16:781. J.H. III. 29:399. G.M. 38:18. There is also a variety called **május.**

32. **divaricàtum,** Lindl. Pseudobulbs compressed, each with a fleshy, oval, apiculate leaf: scape 1½ ft. high, with the branches of the panicle extremely divaricate: sepals and petals oblong-spatulate, greenish yellow, spotted with purple toward the base; labellum yellow, spotted with red; lateral lobes large, half-rotund; middle lobe smaller, emarginate. Autumn. Brazil. B.R. 13:1050. L.B.C. 13:1212. P.M. 3:4.—A floriferous species easily recognized by its singular oval, fleshy leaf and the divaricate panicle.

33. **pulvinàtum,** Lindl. Panicle very much branched, in a loose, spreading manner, weak, 8–9 ft. long: fls. yellow, with the sepals and petals blotched with red; segments obovate, acute; the 2 parts of the labellum nearly equal; lateral lobes rotund-crenate and crisp; middle lobe undulate, crest a villous cushion. Summer. Brazil. B.R. 25:42.—One of the largest of the Oncidiums. The fls. last a long time. Var. **május,** Hort., is said to be desirable.

34. **Wárneri,** Lindl. (*Odontoglóssum Wárneri,* Lindl.). Pseudobulbs ovate, somewhat angular: lvs. linear-lanceolate: raceme short, few-fld.: sepals oblong; petals a little wider; all white or yellowish, striated with rose-purple; labellum brilliant yellow; lateral lobes subquadrate; middle lobe deeply divided into two rounded lobes. Autumn. Mex. B.R. 33:20 (var. *purpuràtum,* Lindl.).

35. **maculàtum,** Lindl. Pseudobulbs ovate, compressed, 4-angled, 2-lvd.: lvs. broadly linear-oblong: fls. 1¼ in. across, yellow, spotted with deep purple; sepals and petals subequal, rather fleshy, ovate-subacuminate; labellum oblong-apiculate, the lateral lobes forming 2 large teeth near the middle; middle lobe ovate, sulfur-yellow, base marked with few red lines, claw with 4 horn-like plates. Winter. Mex. B.M. 3836 (var. *ecornutum*) and 3880. B.R. 24:44. F.C. 2:57 (all as *Cyrtochilum maculatum*).

36. **Limminghii,** C. Morr. Pseudobulbs oval, compressed: lvs. oblong, acute, mottled: raceme 1–2-fld., erect, several times longer than the small lvs.: fls. yellow, spotted and banded with brown; sepals and petals lanceolate, the lower pair larger; labellum with large, auriculate lateral lobes and a transversely broadened, subreniform, emarginate mid-lobe, spotted with red. June, July. Caracas. F.S. 18:1827.—A pretty dwarf plant with the habit of a Sophronitis.

37. **cheiróphorum,** Reichb. f. Pseudobulbs 1 in. long, ellipsoid: lvs. 3–6 in. long, linear-lanceolate: scape bearing a dense panicle longer than the lvs.: fls. about ½ in. across, entirely bright yellow, with greenish sepals; sepals and petals small, rounded-ovate, spreading or reflexed; labellum much larger, with three large lobes, the middle lobe notched. Colombia. B.M. 6278. G.C. 1871:168 (description).

A. *Plants dwarf, scarcely over 8 in. high.*
B. *Labellum with 3 equal lobes.* 38. **pumilum**
BB. *Labellum with small lateral and a 4-parted middle lobe.* 39. **Crista-galli**
AA. *Plants large.*
B. *Wings of the column narrow, falcate* ..... 40. **bicallosum**
41. **Cavendishianum**
BB. *Wings of the column fleshy, rotund, reniform, etc.*
C. *Labellum pandurate, with triangular lateral lobes* ... 42. **Lanceanum**
43. **Carthaginense**
CC. *Labellum reniform, with small blunt lateral lobes* .. 44. **luridum**

38. **pùmilum,** Lindl. A small plant about 6 in. high, without pseudobulbs, and with oblong, leathery lvs.: inflorescence a small, branched panicle, scarcely longer than the lvs.: sepals and petals obovate, yellow, spotted with brown; labellum yellow, rounded, trifid. Spring. Brazil. B.M.3581. B.R.11:920. L.B.C.18:1732.

39. **Crista-galli,** Reichb. f. (*O. iridifòlium,* Lindl., not HBK.). Lvs. radical, cuneiform-ligulate, 2–3 in. long: fl.-stems several, 1–2-fld., slightly exceeding the lvs.: fls. yellow, with few red spots at the base of the segments and labellum; sepals lanceolate, acute; petals oblong, crisp, much wider; labellum large; lateral lobes oblong-cuneate; middle lobe divided into 4 lobes, of which the inner 2 are smaller. B.R. 22: 1911.—A very small, neat plant.

40. **bicallòsum,** Lindl. Pseudobulbs none: lvs. large, oblong-lanceolate, keeled, thick and leathery: panicle many-fld., variable in size: fls. 2 in. in diam.; sepals free, obovate, concave; petals oblong-obtuse, undulate; all rich yellow or honey-colored, bordered with cinnamon color; labellum with small, narrow lateral lobes, and a pair of tubercles for a crest; middle lobe large, transversely expanded, emarginate, subcordate. Autumn and winter. Guatemala. B.M. 4148. B.R. 29:12. I.H. 12:458.

41. **Cavendishiànum,** Batem. Pseudobulbs none: lvs. fleshy, broadly lanceolate, 1–1½ ft. long: scape 4 ft. high, erect, with a dense panicle about 1 ft. long; sepals and petals oblong-obtuse, greenish yellow, with bright chestnut spots; labellum yellow; lateral lobes rather large, spreading, rounded, narrowed to a claw; midlobe broadly reniform and deeply emarginate. Guatemala.—Grows very slowly.

42. **Lanceànum,** Lindl. Pseudobulbs wanting: lvs. fleshy, oblong, acute, 1 ft. long and about 3 in. broad: scape stiff, erect, branched above and 1 ft. or more in length: fls. 2–3 in. across, numerous; sepals and petals oblong, obtuse, fleshy, concave, yellow, marked and barred with chocolate-brown or crimson; labellum narrow in the middle, with the 2 lateral lobes forming a hastate base, middle lobe broadly expanded, cuneate. The color of the labellum is variable, usually rose in front, becoming violet toward the base. Summer. British Guiana. B.R. 22:1887. F.S. 18:1842–43. P.M. 4:169. F.C.2:79. G.C.II.21:609.—Var. **supérbum,** Hort., is described as a superior variety. Var. **Louvrexiànum,** Hort. (*O. Louvrexiànum,* Hort.). A var. with yellow fls., prettily spotted and marbled; labellum yellow at the base, white in front.

43. **Carthaginénse,** Swartz. (*O. Hénchmanni,* Lodd. *O. rósseum,* Lodd. *O. undulàtum,* Salisb. *O. sanguíneum,* Lindl.). Pseudobulbs obsolete: lvs. solitary, oblong, acutish: panicle 3 ft. long and loose: fls. small, whitish, marked and blotched with red and bordered with yellow; sepals and petals oblong-ovate, free, waved; labellum with horizontal, triangular lateral lobes and a fan-shaped middle lobe, crimson, with a yellow border. Summer. Trop. Amer. B.M.3806 (as *O. Hunteanum*). F.C.3:97 (as *O. luridum,* var. *Henchmanni*).

44. **lùridum,** Lindl. Lvs. elliptical, thick, rigid, dull green, 15 in. long: scape sleuder, 3 ft. high, much branched and many-fld.: fls. nearly 1½ in. in diam., dark green or olive-green, with indistinct darker spots; sepals clawed, undulate, crenate, obtuse, warted on the back, the upper one rotund, the others spatulate-oblong; petals larger and without warts; labellum reniform, almost plane. S. Amer. B.M.3608. B.R. 9:727.—The panicle is said to grow to a height of 9 ft. A var. **rósseum,** Hort., is said to have rose-colored fls., spotted with white and bordered with yellow. Var. **guttàtum,** Lindl., has yellow fls. spotted with orange. B.R.25:16.

45. **Papílio,** Lindl. Butterfly Orchid. Fig. 1527. Lvs. oblong, very leathery, olive-green, mottled with purplish brown, 6–8 in. long: peduncle 2–3 ft. long, flattened and jointed, producing fls. several years in succession: fls. 4–5 in. long and 2½ in. across; dorsal sepals and petals erect-linear, with a small lanceolate expanded portion, brown, with bands of yellow; lower sepals lanceolate-falcate, curved downwards, yellow, with heavy bands of brown, labellum pandurate, usually plane, with the middle lobe rounded, transversely broadened, emarginate, yellow, with a broad band of brown around the margin; wings of the column toothed. Fls. at any season. West Indies. B.M.2795 and 3733

1527. Oncidium Papilio (× ⅓).

(var. *limbàtum*). B.R.11:910. L.B.C.11:1086. F.S. 9:920. P.M.5:175.—Variable in color of fls. and lvs. Lvs. sometimes green on the upper surface. F.C.1:12. F.1842:49. Var. **Eckhardti,** Linden. All parts of the flower very large; sepals and petals golden yellow, barred with red; labellum yellow, with a broad margin of brown. I.H.30:500.

46. **Kramerià̀num,** Reichb. f. This species is much like *O. Papilio.* Pseudobulbs rounded, 4–7-angled: stem terete: petals and dorsal sepals shorter than in *O. Papilio,* apex more distinctly dilated; lateral sepals golden yellow, spotted (not banded) with cinnamon-brown, crisp, undulate, finely toothed; labellum very crisp and undulate, finely toothed, pale yellow, with a narrow band of cinnamon-brown spots around the margin; column wings entire. Cent. Amer. F.S. 19:1956. I.H. 41, p. 206.

47. **Jonesiànum,** Reichb. Plants with fleshy, rush-like lvs. 3–12 in. long and usually hanging downwards: fl.-stems 6 in. to 2 ft. long, the largest bearing about a dozen fls. 2 in. across: sepals and petals oblong, wavy, cream-colored, with sepia-brown spots; labellum white, yellow at the base, with a few crimson spots near the isthmus; middle lobe large, subreniform, 2-lobed, wavy; lateral lobes toothed. Fls. at various seasons. Paraguay. B.M. 6982. R.B. 15:7. Gn. 31:583.—The handsomest of the round-leaved species.

48 **Cebolleta,** Swartz. (*O. juncifòlium,* Lindl.). Pseudobulbs very small, each with a single, terete, obscurely furrowed leaf: lvs. 1 ft. long, spreading, harsh in texture: panicle rigid, erect, about 2 ft. high: sepals and petals nearly equal, obovate, greenish yellow, spotted with red; labellum large, bright yellow; lateral lobes

Plate XXII. Onion

The Southern Globe type, now popular in northern markets

broadly obovate; middle lobe broadly obovate or subreniform, undulate, notched in front. Spring and summer. Brazil. B.M. 3568. B.R. 23:1994; 28:4 (as *O. longifolium*).

49. **triquètrum**, R.Br. (*Cymbídium triquètrum*, Swz. *Epidéndrum triquètrum*, Swz.). Pseudobulbs none: lvs. few, 4–6 in. long, triquetrous and grooved: scape about as long as the lvs., purplish, bearing a raceme of 10–12 medium-sized fls.: sepals broadly lanceolate, the lower pair united, purplish green; petals ovate, white, tinged with green and spotted with purple; labellum cordate-ovate, constricted near the middle, white spotted with purple; crest orange. Autumn. Jamaica. B.M. 3393.

A supplementary list of synonyms and imperfectly known kinds advertised in America: *O. ansiferum*, Reichb. f. Sepals and petals oblong-obovate, free, crisp; labellum with ligulate lateral lobes and a reniform, emarginate middle lobe, golden yellow, with 2 dark brown bars at the base, flaccid. The sepals and petals are greenish, with yellow tips.—*O. Baldeviàmæ*, Reichb. f. (O. Balderramæ, Reichb. f.). Panicle ample: dorsal sepals rounded, clawed, crisp, yellowish olive-brown with a yellow border; lower sepals longer clawed, cuneate-oblong, unicolored; petals oblong, short-clawed, crisp, nearly complicate, smaller than the sepals, yellow, with brown blotches: labellum hastate, ligulate, obtuse. Summer. Colombia.—*O. Bictoniénse*, Hort. ex-Lindl.=Odontoglossum Sp.—*O. Fórstermanni*.—*O. fuscàtum*, Reichb. f. = Miltonia Warszewiczii.—*O. Gardneri*, Lindl. (O. Gardnerianum, Hort.). Resembles O. crispum and O. Forbesii. Fls. lemon-yellow, spotted and barred with chestnut-brown on the sepals and petals; labellum broad, yellow, margined with the same color; all segments undulate, crisp. Brazil. G.C. II. 16:86. F.M. 1880:401. This is probably O. curtum, Lindl., which should be referred to this species.—*O. Geertiànum*, C. Morr. (O. cæsium, Reichb. f.). A species probably based on a variety of O. reflexum.—*O. Gravesiànum*, Rolfe. Pseudobulbs broadly oblong-compressed, 3 in. long: lvs. elliptic-oblong, 4 in. long: panicle large, branching: fls. 2 in. across, yellow, spotted with brown; dorsal sepals spatulate; lateral sepals lanceolate-oblong, united at base; petals obovate, wider than the sepals; labellum pandurate, with small spatulate lateral lobes and a broadly orbicular-ovate, undulate middle lobe. Brazil. R.B. 21:73. G.C. III. 11:651. Near O. crispum.—*O. hastàtum*, Lindl. Sepals and petals yellow, spotted with brown; labellum pale yellow. Mex.—*O. lancifòlium*, Lindl. (O. sessile, Lindl. & Paxt.). Pseudobulbs oblong: lvs. short, pale green: panicle much branched and bearing a large number of fls.: sepals and petals large, obtuse, yellow, spotted with cinnamon-brown at the base; labellum large, of the same color. Ecuador.—*O. Lávenderi*.—*O. Lawrenciànum*, Reichb. f. =Brassia Lawrenciana.—*O. murìnum*, Reichb. f. A species with numerous small yellow fls. borne in panicles.—*O. obryzàtum*, Reichb. f. & Warsc. Fls. golden yellow, spotted with brown, borne in a much-branched panicle. Peru. Said to be an elegant winter-flowering orchid.—*O. Reichenbachii*, Lindl. Colombia.—*O. ròseum*, Beer.=Cochlioda rosea.—*O. rupéstre*, Lindl. Fls. numerous, in a branched panicle 2 ft. high, brilliant yellow, spotted with brown. Peru. Said to be desirable.—*O. Russelliànum*, Lindl.=Miltonia Russelliana.—*O. sarcòdes*, Lindl. Pseudobulbs subcylindrical, 3 in. long, 2–3-lvd.: lvs. lanceolate: panicle branched, many-fld., slender: fls. large, yellow, spotted with brown; sepals free, obovate; petals larger, clawed, obovate-spatulate, repand; labellum with small serrate lateral lobes; middle lobe large, emarginate, undulate. Brazil. I.H. 21:165. Near O. ampliatum.—*O. Schilleriànum*, Reichb. f. Trop. Amer.—*O. Schlimii*, Linden. A large, rampant species, with yellow fls. marked with brown, about 1 in. in diam. Nov. Cent. Amer.—*O. spaculàtum*.—*O. stelligerum*, Reichb. f. Sepals and petals oblong-ligulate, stellate, yellowish, with many brown dots; labellum with short, obtuse-angled lateral lobes, a narrow isthmus, and a cordate, rotund, cuspidate middle lobe, pale yellow, with a darker callus. Mex. Near O. hastatum.—*O. Vólvox*, Reichb. f. Venezuela.—*O. Warszewíczii*, Reichb. f. Pseudobulbs rounded, compressed: lvs. 1 ft. long, thin: scape stout, with an 8–13-fld. panicle: fls. yellow, with purple spots and the middle of the labellum blood-red; upper sepals lanceolate, acute, crisp; lower pair oblong, shorter than the labellum, united; petals oblong, much wider than the dorsal sepals; labellum with auriculate lateral lobes and a reniform bifid middle lobe. Colombia.—*O. Wéltoni*, Hort.=Miltonia Warszewiczii. HEINRICH HASSELBRING.

ONCÒBA (Arabian, *onkob*; name of a North African species). *Bixàceæ*. Shrubs or small trees of tropical and subtropical Africa, sometimes spiny. Lvs. alternate, without stipules: fls. terminal, solitary, white, large for this order, bisexual; sepals and petals 5; stamens very numerous, inserted, in many rows on a fleshy wing beneath the ovary; filaments filiform; anthers linear, 2-celled, attached to the base, erect, opening at the sides; stigma dilated, notched: ovary free, 1-celled: style cylindrical: berry leathery, pulpy within; seeds numerous, used as ornaments by the natives.

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Kraussiàna, Planch. A branching shrub without thorns, the older branches having a rough ash-colored bark: lvs. elliptic-oblong, obtuse or subacute, entire, 2 in. long, with midrib, pinnate and netted veins, somewhat pale on under side: peduncles terminal or opposite the lvs., 2–3 in. long: fls. erect, solitary, more than an in. across, white; sepals roundish and very concave; petals twice as long, spreading, with narrow claws, cuneate at base, broadly obovate, with scattered, woolly hairs; anthers pointless; stigma 5–6-rayed: ovary hairy. Procurable in S. Calif. — This makes a very fine pot-plant in a greenhouse temperature, flowering in spring. It is also useful for subtropical bedding. Prop. from ripewood cuttings, also from seeds. Give the plant a sunny position, and plenty of water while new growth is making. M. B. COULSTON and H. A. SIEBRECHT.

ONCOSPÉRMA (Greek, *tumor-shaped seed*). *Palmàceæ*. Stoloniferous palms, with low, very spiny trunks: lvs. equally pinnate; lfts. ensiform-acuminate, entire, equidistant or somewhat clustered, the veins scaly beneath; rachis convex on the back, with a blunt keel above: fr. small. Oncosperma differs from Euterpe in the small, acute sepals: stamens 6–12, the anthers erect; albumen ruminate. Species 6. Trop. Asia.

fasciculàtum, Thwaites. Caudex at length 30–40 ft. high, 5–6 in. in diam.: lvs. 18 ft. long; pinnæ fascicled, 12–18 in. long, 1–2 in. wide, lanceolate, long-acuminate, the tips drooping; sheath 2½ ft., armed and scurfy: fr. globose, black-purple, ½ in. in diam. Ceylon.

JARED G. SMITH.

ONION. Plate XXII. All the Onions of common or general cultivation are forms of one variable species, *Allium Cepa*. This plant is probably native to southwestern Asia, but it has been domesticated so long and has varied so much that its aboriginal form is not well understood. It was grown by the ancient Egyptians. It is grown primarily for its bulbs, but the leaves are sometimes used as seasoning and in stews Under long-continued cultivation and selection, the bulbs have developed into large and shapely organs. Now and then the bulb does not develop and the neck (or stalk just above the bulb) remains relatively thick: such onions are "scullions." Seeds from poorly selected or deteriorated stock may be the cause of scullions: they are to be considered as reverted or run-down forms. Sometimes scullions result from very wet soil, whereby the plants grow too much to top. Seeds grown in the South or in a long-season climate tend to produce plants in short-season regions that do not "bottom" before caught by frost.

The Onion is one of the hardiest of vegetable garden plants. In the southern climates it is grown largely as a winter crop. In the northern states and Canada the seeds are sown or the bulbs planted as soon as the ground can be fitted in the spring. It is always best, if possible, to prepare the ground in the fall in order that the seeds may be sown on the first approach of warm weather. When Onions are grown from seeds, it is essential that the ground be fine and loose, and all surface stones and litter removed. The seeds are small and do not germinate quickly. The young plants are surface feeders. If the seed is sown late or if the ground is droughty, the plants will either perish or make no headway. Land which is foul with weeds should not be planted to Onions, for the young Onion plants cannot withstand such competition. In the old-fashioned gardens, it was the custom to plant Onions in short rows crosswise of raised beds, as in Fig. 1528. This entailed an endless amount of small hand labor and usually resulted in the expenditure of more time and effort than the Onions were worth. The better method is to grow the plants in long rows which are far enough apart to admit of the use of a wheel hoe. Fig. 1529. Even when a small quantity of Onions is desired, it is better to place them all in one row than to have many short rows. With the best of land and management, and with the use of wheel hoes, more or less finger work will be necessary in order to bring the crop to full perfection. The seed may be sown thick in the home garden, and as the young plants begin to crowd, they should be thinned. The plants taken out in the second

and third thinnings may be used on the table. Fig. 1530. It is very important that the best grade of seed be used, for the Onion deteriorates rapidly from seed which is not well grown nor carefully selected. There are great numbers of varieties. The most popular standard field kinds are Southport Red and Yellow

1528. The old-time Onion bed.

Globe, and these are also to be advised for the main reliance in the home garden. For early use and for variety, great numbers of kinds may be selected from reliable seed catalogues. Some of the quick-growing southern Onions are excellent for early use.

There are two general methods of propagating the Onion—by seeds and by bulbs. Onion seed is ordinarily known as "black seed," although there is no Onion seed which is not black. The main field crop is grown from seeds, as explained in the articles which follow. The Onion seed of the market is produced from full grown and typical bulbs of the desired variety. These bulbs are grown from seed and are kept over winter as other Onions are. In the spring they are planted out in rows two feet apart and as near together in the row as they will stand. They send up a flower stalk which blooms in early summer, and the seed is harvested.

Propagation by bulbs is employed for the purpose of securing early Onions for home use or for the special early-season trade. Until within recent years, all the very early or bunch Onions were raised from bulbs, but recently a so-called "new Onion culture" has come into vogue, which consists in sowing seeds in hotbeds or coldframes and transplanting the young plants. Bulb-propagation is of three general categories: (1) The use of bulblets or "top Onions" which appear on the top of the flower-stalk in the place of flowers; (2) the use of bulbels or separable parts of an Onion bulb, known as "multipliers," or "potato Onions"; (3) the use of ordinary bulbs which are arrested in their growth, known as "sets."

Bulblets, or top Onions, are shown in Fig. 1531. If one of these bulblets is planted in the spring, it quickly produces a young bulb, and the growing bulb may be pulled at any time and eaten. If allowed to remain in the ground, however, it sends up a stalk (either the first or second year) which bears a cluster of bulblets, sometimes mixed with flowers, on its top. There are two or three strains of top Onions on the market, although the leading ones are the white and the red, these names applying to the color of the bulblets. The so-called "Egyptian Onion" is a top Onion; also the "tree Onion."

1529. The new-time Onion field.

Multipliers are shown in Fig. 1532–3. Instead of containing a single "heart" or core, as in most Onions, it contains two or more. When the Onion is planted, each of these cores or bulbels sends out leaves and grows rapidly for a time; that is, the old or compound bulb separates into its component parts. The growing bulbels may be pulled and eaten at any time. If allowed to remain in the ground, each of these bulbels will make a compound bulb like that from which it came. Sometimes flower-stalks are produced from multiplier or potato Onions. The best results with multipliers are secured when the bulbels are separated on being planted, for each one has room in which to grow. Two or three kinds of multiplier Onions are known, the variation being chiefly in the color of the bulb.

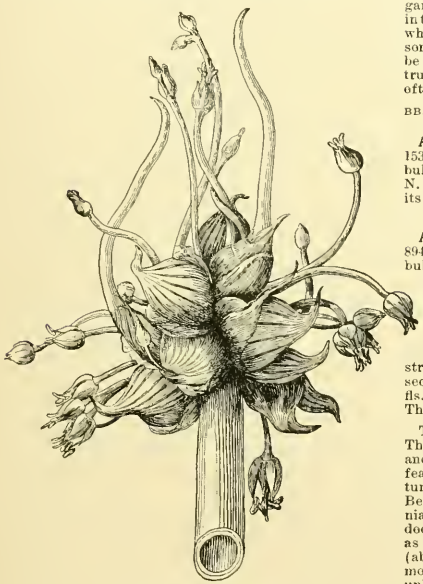
Onion sets are merely ordinary Onions which are arrested in their growth, and when planted will resume growth. They are grown from seed. The seed is sown very thick on rather poor land, so that the young bulbs soon reach the possibilities of their growth: they mature when still very small. These small bulbs or sets are then harvested and kept over winter, and used for planting the following spring. When planted they grow rapidly and may be pulled and used for the table. If allowed to remain in the ground, they send up flower-stalks and produce seeds, as common Onions do. Sets are not allowed to seed, however, since the seeds from sets would probably produce an inferior race of Onions. Any variety of seed-bearing Onion may be grown and propagated as sets, although there are relatively few that give uniformly good results. In the trade, Onion sets are usually designated as yellow, red or white. In order to secure good results from Onion sets, it is essential that the sets be small and firm. They should not be over one-half inch in diameter, if they are of the best. If they are much larger than this, they tend to run to seed rather than to produce bulbs. Sometimes the very small and inferior Onions are saved from the regular crop and are used as sets the following spring. Such sets are generally known as "rareripes." Usually they do not give the best results.

The varieties of Onions are numerous. In 1889 (Annals Hort.) 78 varieties of "seed" Onions were

1530. Bunch Onions from the early spring sowing.

offered by American dealers, and also about 20 kinds of multipliers, potato Onions and sets. For purposes of careful scientific study, the varieties may be classified into geographical races, but for purposes of description they may be assembled into groups characterized by such arbitrary features as form and color of bulb.

Goff (6 Rep. N. Y. State Exp. Sta., for the year 1887), classifies first by shape of bulb and then by color. He makes four primary groups: bulb oblate, spherical, top-shape, oval or pear-shape. Each of these groups is divided in three sections: color white, yellow or brownish, red or reddish. Another classification (Bailey, Bull. 31 Mich. Agric. College, 1887), makes three primary sections on methods of propagation: propagated



1531. Top Onions (×½).

by division (multipliers), by bulblets or "tops," by seeds (or sets). The last section (seed Onions) is divided into bulbs silvery white and bulbs colored, and these groups are again divided on shape of bulb.

Aside from the chapters on Onions in the vegetable-gardening manuals, there are special treatises, as Greiner's "Onions for Profit," and "The New Onion Culture," Greiner and Arlie's "How to Grow Onions," and the Orange Judd Company's "Onion Book."

The cultivated onion-like plants may be named under six species, as follows:

A. *Leaves terete and hollow.*

B. *Plant annual or biennial, the bulbs evident.*

Allium Cépa, Linn. Common Onion. Bulbs various, but distinctly rounded at top and bottom: scape tall and stout (usually 2–3 ft.), enlarging in the middle, glaucous, much exceeding the large soft hollow leaves: fls. in round umbels (Fig. 1534) white or blush. Persia and adjacent regions.

Var. **bulbellífera,** Bailey. Top or tree Onion.

Var. **múltiplicans,** Bailey. Multiplier or potato Onion.

Allium fistulósum, Linn. Welsh Onion. Ciboule. Fig. 1535. No distinct bulb, but only an enlargement at the base: lvs., scape and fls. much as in the Common Onion, except that the plant is usually lower when in bloom and the leaves are more clustered. Siberia. B.M. 1230.—Grown for its leaves, which are used as seasoning. It is as hardy as the Onion. It is grown preferably from seeds, but the roots may be divided. The seeds are usually sown in the fall, unless the climate is severe, and the leaves are ready for early spring use.

Allium Ascalónicum, Linn. Shallot (which see). A small plant, with short awl-shaped leaves, and an umbel of lilac fls., but distinguished chiefly by the small oblong-pointed clustered bulbs. These bulbs are borne on a common disk, forming a more or less compact compound bulb that reminds one of a multiplier onion or garlic. It is native to Syria.—The Shallot is rarely seen in this country. It is grown for the little bulbs or "cloves" which are used as Onions are. The young leaves are sometimes used for flavoring. The bulbs or cloves may be planted in early spring, the same as onion sets. The true Shallot rarely blooms. A small strain of Onion is often known as Shallot.

BB. *Plant truly perennial, producing a dense sod-like clump.*

Allium Schœnóprasum, Linn. Cive (which see). Fig. 1536. One ft. or less high, in a tough clump, scarcely bulbous, producing umbels of rose-purple fls. in spring. N. Eu. and the northern part of N. Amer. Grown for its leaves, which are used for seasoning.

AA. *Leaves flattish, not hollow.*

Allium sativum, Linn. Garlic (which see). Fig. 894, page 628. Bulbs small, breaking up into many small bulbs or "cloves:" lvs. very narrow, keeled: fls. purplish, but usually not forming or replaced by bulblets. Eu.—Grown for the bulbs, and cultivated like Onions grown from seeds.

Allium Pórrum, Linn. Leek (which see). Fig. 1537. Strong, robust plant, with the simple bulb little thicker than the stout neck: lvs. very broad and strongly conduplicate or keeled: scape produced the second season, bearing a large umbel of white or blush fls. Eu. Grown from seed, after the manner of Onions. The leaves and bulb are eaten.

L. H. B.

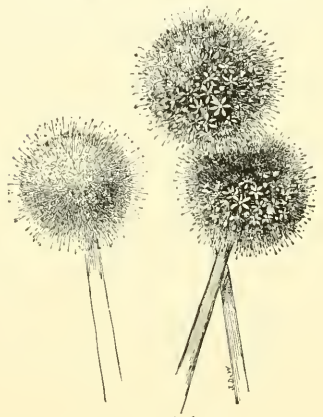
The New Onion Culture (*Transplanting Process*).—The idea of raising Onions by growing seedlings in beds and transplanting to the open, which are the essential features of what has been termed "the new Onion culture," is not new. It has long been put in practice in the Bermudas, among the Portuguese growers in California, and in various places in Europe. This, however, does not detract from the credit due to the writer, as well as to Prof. W. J. Green, of Ohio, for the rediscovery (about 1889) of this old, but in their localities and in most portions of the United States before that wholly unknown, plan of Onion-growing. There are only few, if any, modern innovations which have left an equally deep impression on our garden practices. The transplanting method is admirably adapted to the character of the large foreign Onions, especially those of the Spanish type, and by it the American grower is enabled to produce bulbs in every way the equal of those large sweet Onions which are imported from Spain and other foreign countries, and sold in our groceries at 5 to 10 cents per pound. A portion of the Onions now palmed off on the unsuspecting buyer in various places as "imported Spanish" are really nothing more than these home-grown bulbs of the Prizetaker variety, and the buyer is not the loser by any means. This Prizetaker is perhaps the best of this class of Onions to be grown by the transplanting process at the present time—large, of good shape, perhaps a little darker in color than the imported Spanish, and its equal in mildness of flavor. The newer Gibraltar is still larger, milder, a little later,

1532. A multiplier Onion.

1533. Section of a multiplier Onion.

not as good a keeper, but altogether one of the best Onions which the home grower, as well as the market-gardener who can sell his crop before late fall and at good prices, could produce.

Start the plants under glass (preferably in greenhouse) during January or February, sowing seed rather



1534. Onion in flower.

thickly in drills an inch and a half or two inches apart, and using about an ounce of seed to ten square feet of bed surface. The soil should be sandy and very rich. Keep the plants in good growth, and as soon as the patch outdoors can be properly prepared in spring, set the seedlings in rows about 14 inches apart, and from 3 to 4 inches apart in the rows. Little hand-weeding will be necessary, but the wheel-hoe should be used freely. We also grow a portion of our green or bunching Onions in this way. For that purpose the plants are set more closely in the rows, say not over 2 inches apart. Seed of the Prizetaker is mostly grown in the United States, while that of the Gibraltar is as yet all imported.

T. Greiner.

Commercial Onion Culture in the North.—*Soil.*—The soil should be a rich, moist, but not wet, loam with a subsoil of clay, or close compact sandy loam, not coarse gravel, as that lets the water leach out too quickly. Onions will stand a large amount of fertilization, and there is little danger of getting the soil too rich. Soil that has been under cultivation for three or four years at least is much better than new land. The tendency of the latter is to produce too much top-growth and improperly ripened bulbs.

To prepare the soil, plow 10 or 12 inches deep, if the soil is of sufficient depth, or down to the subsoil. Care should be taken not to turn up much subsoil, or the crop will not mature evenly.

Fertilizers.—If the soil is poor, plow in 5 to 10 cords of stable manure to the acre, and spread on an equal amount of well-rotted manure after plowing, to be harrowed in. Unleached hard wood ashes is also a good fertilizer, especially on rather dry land, as it aids in the conservation of moisture. The action is quick, which makes it valuable where a little of the subsoil has been turned up in plowing, giving the young plants a good start, when, without it, they would be too light-colored and weak in growth. Ashes should be spread as evenly as possible, 75 to 100 bushels per acre on the ground after plowing, and harrowed in.

Tillage.—The harrowing should be thorough, using some kind of a disk or spring-tooth, for the first time over, with a Meeker or some other smoothing harrow for the finish. It is impossible to get a good even stand of plants if the ground is rough or lumpy, while those that do grow are weak and puny on rough ground. Hand-raking is sometimes necessary to insure germination of seed in a satisfactory manner.

Drainage.—The drainage must be nearly perfect to get best results. There should be no hollow places in the beds. Even on a sloping piece of land, the dead furrows or alleys should be kept open. If there is a natural sag in the land which cannot be surface-drained, it is often practicable to underdrain so as to get satisfactory results; for there is no crop grown in the ordinary market-garden which will pay a larger percentage of return for underdraining, in nearly all locations. If the foliage is of a light color, and the crop does not ripen evenly, an underdrain will usually correct the trouble. The time to drain is when the ground is being prepared for planting, not after a heavy rain, when water is standing in pools over the field.

Onion Seed.—There are a few growers who can profitably grow their own seed, but the masses should buy. This should be done early, so that there may be no delay at planting time, and also that one may get the best stock obtainable. If one wants 10 pounds or more it is sometimes advisable to order from some one of the large seed houses of the country, but if there is a reliable local dealer who buys seed in bulk, go to him and make your wants known and you can often do better than to send direct to the large seed house, even on quantities of 50 to 100 pounds. Be sure to know where the seed comes from, and if possible test it before planting. In any case always buy the best seed obtainable, no matter if it costs double the price of other stock.

The sowing of the seed should be done with one of the standard garden seed drills, the first essentials of which are that the machine can be regulated to sow evenly and in the quantity desired without clogging. The machine should open a row, sow, cover, roll, and mark the next row, all at one operation. The machines which have a sliding piece at the bottom of the hopper, which opens and closes a diamond-shaped opening, are the best, as the operator can regulate exactly the amount of seed sown.

The seed should be sown in rows 12–14 in. apart, and at the rate of 3½–4½ pounds per acre, according to soil and seed. A soil which produces heavy tops requires less seed than the drier, sandy soil which grows small tops. The plants should stand from 1–3 in. apart in the row. The seed should be sown from ½–1 in. deep, according to soil.

Tillage should begin as soon as the plants are up enough for the rows to be seen. Begin with a double-wheel straddle cultivator if one is at hand, setting the knives as closely as can be worked without covering the young plants, and continue as often as necessary to keep weeds destroyed and the ground loose on top until the plants are too large to get through. The last time through may be done with a single-wheel machine, which will throw a little earth up to the plants. A single-wheel machine may be used throughout the season, but the double-wheel is preferable for the first part of the work.

1535. Allium fistulosum—Welsh Onion.

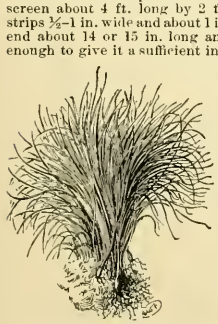
A hand-weeder may be used with profit after the young plants have gotten 3–5 in. high. This works two rows at one passage, stirring the soil in the rows where the wheel-hoes do not work, and greatly reduces the amount of hand-weeding to be done. Of course, hand-weeding must be done as often as necessary to keep the beds clean.

Harvesting may be done in the following manner: If the crop ripens evenly, so that there are no green tops standing, the topping can be done most rapidly before the Onions are pulled. By using a thin, sharp knife, taking the dry tops in one hand and cutting from the person, the work can be done quickly and well. Be careful not to tear the skin down the side. The length to cut the tops is a point of importance and must not be overlooked. If the tops are left too long they have a ragged appearance, and if too short, there is danger of causing the Onions to rot in the tops, because of bruising or because of water having gone to the inside of the Onions. The proper length is about half an inch from the bulb; or, take an Onion by the top, with the thumb and forefinger close to the bulb, and cut the top close to the fingers. The pulling may be done by hand, but a puller made to fit a hand-cultivator is much more rapid and does not injure the bulbs. The puller is simply a knife with one or more fingers to move the bulbs slightly as the roots are cut. In light, dry soil it works very well without any fingers.

Many growers prefer to pull the Onions first, allowing them to dry a few days before topping. This is what should be done if the tops do not dry evenly, or if the crop is late and needs to be hurried; and is all right in any case, though not quite so rapid as the other way.

Storage.— After the Onions are topped they should be gotten under cover as soon as possible. Let them dry a day or two if the weather is favorable and then pick them up and store in the curing shed. If allowed to lie too long on the ground the skin peels off too much. The shed should have doors or ventilators at each end from top to bottom, so that the air can pass through freely and be free under the floor. If the floor is tight, with no circulation under it, lay some 2 x 4 scantling on the floor and lay a loose board floor over them without nailing; then take some pieces of 2 x 4 sawed just 1 ft. long and nail them to the floor at even distances for posts to carry stringers for the next floor. Use 2 x 4 for the stringers; set them on edge, nail them to the posts and all is ready for the Onions. This gives a space of 16 inches. Fill 12 inches (the length of the posts) and leave the 4 inches for air space. Lay another floor and proceed as before, being careful to get the upper posts directly over the lower ones, or the stringers will break after two or three floors are in.

In handling the Onions, bushel boxes are the most convenient. Pick them up in common baskets, leaving all small, defective, or odd-colored bulbs on the ground, to be picked up separately and sorted as occasion may require. Dump in the boxes, then drive along the side of the bed with a platform wagon, and load. Have a screen about 4 ft. long by 2 ft. wide made of narrow strips ½–1 in. wide and about 1 in. apart. Put legs on one end about 14 or 15 in. long and on the other end long enough to give it a sufficient incline to make the Onions roll down freely. With an old coffee sack make a bag like a sheet hung by the corners with hooks, to hang under the screen, in order to catch the dirt and leaves. Carry the boxes of Onions directly from the wagon to the screen and pour them over it. This will take out all the dirt and most of the loose leaves, and make the Onions come out of the shed in much better shape. They should lie in the shed until they are dry enough to peel off another skin, and rattle and crackle when the arm is run in among them.



1536. Allium Schœnoprasum Cive.

If all has gone well the crop should average 500 bushels to the acre on good land, or 600 bushels on very rich land, and 700 or 800 bushels on a single acre selected from the best part of a ten-acre field.

Marketing.— There is an old saying, "The time to sell is when someone wants to buy." This is a very good rule to apply, unless one is prepared for cold weather or is reasonably sure of an advance in price. In a general way it is best to ship in sacks of even size and not too large, one and three-fourths to two and one-fourth bushels. These points must be governed by the market. In sacking to ship, always throw out all defective bulbs and all of another color. In size down to about 1½ to 1¼ inches in diameter is a good scale to use in a general way, but this point must also be governed by the market. Sell by sample as far as possible.

1537. Leek—Allium Porrum.

Varieties.— There are three varieties of Onions which take the lead clearly above all others in the big markets of the country,— the White Globe, Yellow Globe, and Red Globe. These come under different names, as Southport Yellow Globe and Michigan Yellow Globe, but the object in view among seed-growers is to get bulbs as nearly globe-shaped as possible. The skin should be thick and two or three layers deep, to prevent bruising.

IRVING C. SMITH.

ONION CULTURE IN THE SOUTH.—Twenty years ago Onion-growing from seed was not considered practicable, and by many it was considered impossible south of the Potomac. The introduction of varieties from South Europe and more careful attention to details of the work have made Onion-growing not only possible but often exceedingly profitable.

The eastern South consumes large quantities of the mild forms, such as the Bermudas. In the markets at Jacksonville, Fla., these are sold by the piece, frequently retailing at 5 cents and 10 cents each. Nowhere in the South are Onions grown exclusively on an extensive scale, but they form a supplementary crop, or may be grown extensively at times. The southern Onion-grower must keep in close touch with the northern and foreign Onion markets. As there are no extensive cold storage plants, the crop must be sold soon after ripening. The extensive Onion-grower of this section must therefore keep his land in proper tilth and wait for the year when the price of Onions will warrant his planting.

Soil.— The soil should be alluvial, sandy, and of a fine texture. A level tract, freed of all debris, and one that can be plowed deeply, is desirable. In the coast region such land may be obtained in great abundance. It is frequently used for vegetable-growing, but large areas are still uncleared or are used for farm crops. In the hilly regions of the interior, Onion lands must be sought mainly along rivers or old river beds.

Fertilizer.— Undecomposed vegetable matter should not be applied immediately preceding the crop. Even cotton-seed meal should be used three weeks or more before the seed is sown and then carefully incorporated with the soil where the rows are to be, or if the rows are to be a foot or 14 inches apart the cotton-seed meal may be sown broadcast and cultivated in.

When the land is deficient in the three ingredients considered essential in fertilizers, the following formula will supply the approximate proportion taken off by a crop of Onions:

Nitrogen	5%
Phosphoric acid, available	6%
Potash	9%

From one to two tons of the above formula will not be found excessive, but the amount that will give the greatest profit will be different on each field.

The following table gives the amounts of different

substances which are required to give the desired amounts of each of the three elements:

Nitrogen.	1,600 to 3,200 lbs. cotton-seed meal. 1,400 to 2,800 lbs. guano.* 1,000 to 2,000 lbs. dried blood. 700 to 1,400 lbs. nitrate of soda. 500 to 1,000 lbs. sulph. ammonia.
Phos. acid	1,200 to 2,400 lbs. acid phos. 1,000 to 2,000 lbs. dissolved bone.
Potash...	2,200 to 4,400 lbs. kainit. 700 to 1,400 lbs. low-grade sulfate of potash. 360 to 720 lbs. high-grade sulfate of potash. 360 to 720 lbs. muriate of potash.

*If guano is used, reduce the potash 33 per cent and the phosphoric acid 50 per cent, since guano contains large percentages of these elements.

Seeding.—Seed-sowing in the field occurs in the upper districts as early as the first of April or a little earlier, in the central district about the last of February, while in the Gulf region it may occur late in fall or any time during the winter, being gauged largely by the time required for the variety to mature, and the market to be met. It is a good rule to put on an abundance of seed, about twice as much as recommended in general, especially in the Gulf region. Many fields suffer from deficient stand more than from any other cause, and in some years it is the only cause for an unprofitable crop.

Sets.—Good crops may be grown from sets, but the labor involved and cost of the "seed" is usually so great as to deter many from planting them. In using sets they should be separated into three or four grades, the largest size maturing earliest and the smallest last. In most cases the smallest sets grow such inferior Onions that they would better be discarded. This takes for granted that the sets were all grown at the same time and from the same seed in one field.

Growing Sets.—Nearly all the sets used in the South are shipped in, while they may be grown as well here as anywhere. In the Gulf region there is time enough to grow a crop of sets after the northern crop has been harvested and marketed. Thus in case of shortage in northern-grown sets, it is entirely practicable to ship the seed south, grow sets, and ship sets back in time for spring market.

The New Onion Culture.—Much has been written and spoken about raising the plants in a seed-bed and then transplanting to the field. While this may be practiced successfully, the greater quantity of Onions is raised by the old-fashioned method, i. e., by seeding in the drills where the plants are to mature bulbs.

1538. Creole Onion.

In certain localities it is advantageous to plant out a seed-bed before the general field will permit working, and then transplant as soon as all conditions are favorable. In the upper districts of the South, seed may be sown in hotbeds as early as the first of February, and the plants may usually be set out by the first of April. In the central South, seed may be sown in protected coldframes as early as the middle of December, or in an open bed in February. The earlier plants may be transferred to the field by the last of February, or as soon as danger from frosts is past. In the Gulf region the seed may be sown during the fall in an open bed, and transplanting to the field may occur when plants are of proper size and favorable condition of weather prevails.

Harvesting is often attended with considerable difficulty, and in some cases special drying houses have to be constructed to secure the crop in first-class condition. The crop is a perishable one, and must be pulled, gathered and shipped in as short a time as possible, when sufficiently mature.

There seems to be no generally accepted plan for marketing, the crop being placed in boxes, barrels or bags for shipping.

Varieties.—The following varieties have given good crops in the hands of expert growers and may be recommended for the entire South: White Bermuda, Red Bermuda, Prizetaker, Yellow Danvers, Giant White Italian, Giant Rocco, and Large Tripoli. Other varieties than those named here have given as good or better returns, but do not seem to have been so generally successful. In addition, are Creole (Fig. 1538) for Gulf region and Red Wethersfield for central and upper district.

Diseases.—Black Mold (*Mucrosporium Porri*): This disease spreads rapidly over the field, especially late in the season. Some good may be done by spraying with Bordeaux mixture, but its application is limited almost to the diseased portion.

Smut (*Urocystis Cepulæ*): The name of this fungus, smut, describes it fairly well. About all that can be done is to subject the field to rotation, and to sow seed from smut-free districts. Some years nearly all southern-grown Onions brought to market will be more or less infected.

Rotting is especially severe in wet seasons when the crop cannot be properly handled, and is caused by a number of fungi. Best preventive is to store in a dry place, and consume as soon as practicable.

Insects.—Onion fly, or Onion maggot, is one of the most severe pests when it enters the field. There seems to be but little encouragement in combating the pest. It often leaves the field as mysteriously as it appeared. This disappearance has been coincident with the application of some supposed remedy, and has consequently led to the recommending of unreliable remedies. A thorough application of ground tobacco stems down the row seems to act as an insecticide and a repellent, besides being of value as a fertilizer.

Thrips: These insects attack the leaves at times, and become so numerous as to cause the tips to turn brown and finally destroy the whole leaf. Besides the insect injury they open the way for such fungi as Macrosporium. This insect may be treated successfully with kerosene emulsion, tobacco decoction, resin wash and possibly with kerosene-water mixture. P. H. Rolfs.

ONION, SEA. *Urginea maritima;* also applied to *Ornithogalum caudatum.*

ONÓBRYCHIS (Greek, *asses' food*). *Leguminòsæ.* This genus includes the forage plant called Sainfoin or Holy Clover. It is a perennial herb, which grows a foot or two high, and has numerous small, oblong lfts. forming an odd-pinnate leaf, and spikes of light pink fls., borne in summer on long, axillary peduncles. Its stipules are thin, brown and pointed. The pod is semi-circular, flattish, wrinkled, and bordered with short prickles or teeth. Sainfoin requires a limestone soil, and in the U. S. is grown chiefly in the southern states. In some sections it is considered indispensable, as it increases the flow of milk. The seeds are thought to be more nutritious than oats, and are eaten by fowls. A hundred pounds of seed is sown to the acre.

viciæfòlia, Scop. (*O. sativa,* Lam. *Hedysarum Onóbrychis,* Neck.). Sainfoin or Saintfoin. Holy Clover. Described above. Eu., Asia. For a picture and further information, see Bull. 2, Div. Agrost. U. S. Dept. of Agric., by Jared G. Smith.

ONOCLÈA (Greek *closed vessel;* alluding to the closely rolled sporophylls). *Polypodiàceæ.* A small genus of coarse ferns of north temperate regions, with creeping rootstocks, anastomosing veins and two sorts of leaves, the segments of the sporophylls being closely rolled about the sporangia into bead-like bodies. For *O. Struthiopteris,* see *Matteuccia.*

sensibilis, Linn. Sensitive-fern. Fig. 1539. Our native species, with broad triangular lvs., growing in low, wet places. L. M. Underwood.

Onocleas are tenacious of life, and will grow under almost any conditions, especially *O. sensibilis,* but

they prefer a moist, rather heavy loam, in a cool but not necessarily shaded position. *O. Struthiopteris* (a *Matteuccia*) in the sunny border is likely to burn during severe drought. It is a suitable deciduous fern for the greenhouse, and may easily be had in foliage before their natural season. F. W. Barclay.

1539. Sensitive-fern—Onoclea sensibilis.
Fruiting frond at A.

ONÒNIS (old Greek name of dubious meaning). *Leguminòsæ*. Rest-Harrow. About 60 species of half-shrubby or rarely shrubby herbs, natives of the Mediterranean countries, annual, biennial or perennial. Lvs. usually pinnately trifoliolate, the stipules attached to the petiole: fls. yellow, purple, pink or rarely white, solitary, 2–3 in the axils or in peduncled racemes; calyx bell-shaped, 5-parted, deeply cut, narrow; standard large, striped; stamens united in a tribe, the members sometimes partly free; pedicel awn-like: pod usually swollen, few-seeded, without foot-stalk.

A. *Fls. in groups of 2–3, rose-colored.*

rotundifòlia, Linn. Round-leaved Rest-Harrow. A neat, attractive, shrubby, hardy plant 1½ ft. high. Lvs. trifoliolate; lfts. subrotund to ovate, serrate: peduncles axillary: racemes 2–3 fls.: fls. pea-like, bright rose, not bracted; standard striped with lines of a deeper shade. Of easy cultivation in border and rockery, not liking too much shade. Prop. by division or seed. Summer. B.M. 335.

AA. *Fls. solitary, yellow.*

Nàtrix, Linn. Goat Root. Yellow-flowered Rest-Harrow. Low, much-branched perennial: stem 1–1½ ft. high: lvs. trifoliolate; lfts. elliptical or oblong, serrated near the apex or sometimes entire; stipules large: fls. axillary, the standard finely striped with red. Midsummer to fall. B.M. 329. M. B. Coulston.

ONOPÓRDON (ancient Greek name). *Compósitæ*. The Scotch Thistle, *O. Acanthium*, is a vigorous biennial plant, growing 5–7 ft. high, with cottony white, spiny foliage, and heads of pale purple fls. 1½–2 in. across, borne singly on the branches. It is not advertised for sale in America, but is sometimes cultivated for "auld lang syne," and occasionally it is used with striking effect by some lover of hardy plants. It is then placed against a background of dark shrubbery, which sets off the silvery foliage and bold habit of the Scotch Thistle. The plant is rarely found growing wild in the Atlantic States, having come from Europe. The Scotch Thistle will probably never be a weed of the first importance in America, as is the Canada Thistle. Nevertheless, care should be taken not to let it go to seed. A white-fld. Scotch Thistle was advertised in Germany in 1894 as a horticultural novelty.

Onopordon is a genus of about 12 species of coarse, woolly, Old World herbs, with stout stems winged by the decurrent bases of the lvs., which are large, alternate, prickly, dentate or pinnately cut: involucre globose, the bracts imbricated in many series, and in some cases spiny: receptacle flat, fleshy, honeycombed, not bristly: pappus not plumose, but with bristles in several series.

Acánthium, Linn. Scotch Thistle. Much-branched, 3–9 ft. high: lvs. oblong, lobed and dentate, acute, the lower often 1 ft. long. July–Sept. B.B. 3:491. Gn. 46, p. 9. R.B. 20, p. 200. Var. **álba,** Hort. Gt. 45, p. 107.—The Scotch Thistle is often called the Cotton Thistle; sometimes also Argentine, Asses', Down, Oat, Queen Mary's or Silver Thistle. W. M.

ONÓSMA (*onos*, an ass, and *osme*, smell; the odor reputed to be liked by that animal). *Borragináceæ*. About 70 species of bristly hardy herbs or undershrubs, with long, narrow, alternate lvs. and one-sided, simple or cymose, bracted racemes: the fls. yellow or purple, tube-like, or inflated on one side, sessile, or with short pedicel: calyx 5-parted or cut; corolla-throat dilated or contracted; lobes 5, very short; stamens 5.

* **stellulàtum,** Waldst. & Kit. Golden-Drop. Cult. only in var. **Taùricum** (*O. Taùricum*, Pall.). Stems branching from ground: lvs. linear-lanceolate, with revolute edges; scape branching, leaning, 6–9 in. high; raceme terminal, pendulous: fls. yellow, tubular, expanding above, 8–12 in a raceme, 1¼ in. long. July, Aug. Perennial. Succeeds well on high ground or on sunny rockery, with light, open, deep soil. Prop. by cuttings generally, or by seed. B.M. 889. G.C. II. 16:21. J.H. III. 35:11. Gn. 50, p. 251.

J. B. Keller and M. B. Coulston.

ONOSMÒDIUM (like *Onosma*, a European genus of this family). *Borragináceæ*. False Gromwell. Five or 6 species of North American and Mexican branching herbs, generally perennial, bristly, 1–4 ft. high. Lvs. oblong, sessile, ribbed-veined: fls. white, greenish or yellowish, in long, erect, leafy, raceme-like clusters; corolla tubular or oblong-funnel-shaped, with throat naked, the lobes erect, acute; the sinuses more or less inflexed; style filiform or capillary, very long; stigma

1540. Onychium Japonicum.
(× ¼.)
Showing fertile and sterile fronds.
(See Onychium, p. 1142.)

exserted before the corolla opens: nutlets ovoid or globular, bony, smooth and polished, white. Closely related to Lithospermum.

Carolinìanum, Torr. Stout, branched, 1–3 ft.: lvs. ovate-lanceolate or oblong-ovate, sessile, 5–9-ribbed, 2–4 in. long: fls. yellowish white. June. Can. and western N. Y., west and southward.—Offered by western dealers in hardy plants. Prop. by seeds. M. B. Coulston.

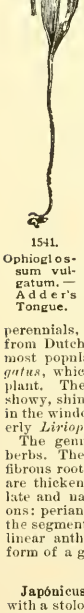
ONTARIO. See *Canada.*

ONÝCHIUM (Greek, *onyx*, a claw; referring to the shape of the lobes of the lvs.). *Polypodiàceæ.* A genus of small, mainly Asiatic ferns, with the sori arranged on a continuous linear receptacle, as in Pteris, but with narrow segments in which the indusia extend nearly to the midrib. For culture, see *Fern.* The orchids occasionally advertised as Onychiums are Dendrobiums.

aurátum, Kaulf. Lvs. ovate, a foot or more long by half as wide, quadripinnatifid, with membranous indusia and abundant sporangia of a golden color; divisions of the sporophylls pod-like. India and adjacent islands.

Japónicum, Kunze. Fig. 1540. Lvs. ovate, a foot or more long by half as wide, quadripinnatifid, with pale indusia and brown sori; divisions of the sporophylls linear-mucronate, similar to those of the sterile leaf. India, Chiua, and Japan.

L. M. UNDERWOOD.



1541. Ophioglossum vulgatum. — Adder's Tongue.

OPHÈLIA. See *Swertia.*

OPHIOGLÓSSUM (Greek, *serpent's tongue*). *Ophioglossàceæ.* A genus of small, fern-like plants of wide distribution, with a more or less elongated terminal spike formed of two rows of coalescent sporangia, and bearing a single leaf at or below the middle of the stem. Rather difficult of cultivation, and mainly of interest as curiosities.

vulgátum, Linn. ADDER'S TONGUE FERN. Fig. 1541. Six–12 in. high, with a spike ¾–1 in. long, bearing a single ovate leaf near the middle of the stem. In low places, Europe and North America.—May be cult. in moist peat in a partially shaded spot. Occasionally found in large numbers in peaty meadows.

L. M. UNDERWOOD and F. W. BARCLAY.

OPHIOPÒGON (Greek, *snake's beard;* a translation of the Japanese name). *Hæmodoràceæ.* Of this genus we cultivate 2 species of hardy, low-growing herbaceous perennials from Japan, with linear foliage, which is often striped or spotted with white or yellow, and racemes of small, 6-parted, pendulous fls., varying from white through lilac to violet-purple. The species mentioned below are not very exciting. They are procurable from a few dealers in hardy perennials, from specialists in Japanese plants and from Dutch bulb-growers. J. B. Keller writes that the most popular form is *O. Jaburan,* var. *aureus variegatus,* which is chiefly used as a greenhouse foliage plant. The fls. of *O. Jaburan* are followed by large, showy, shining dark blue berries. It is easy to manage in the window, and is almost hardy. *O. spicatus* is properly *Liriope spicata.*

The genus is an oriental one of about 7 species of herbs. The plants have a short, thick rhizome, and the fibrous roots sometimes act like runners, and sometimes are thickened into tubers: lvs. linear or oblong-lanceolate and narrowed into a petiole: bracts small, scarious: perianth-tube none; stamens 6, fixed at the base of the segments; filaments erect, distinct, shorter than the linear anthers: cells of ovary 2-ovuled: seeds in the form of a globose berry.

A. *Lower fls. in groups of 2–3.*

Japónicus, Ker. Perennial, stemless, glabrous herb, with a stoloniferous rhizome: fibrous roots long, slender, often nodulose: root-lvs. numerous, erect, narrowly linear, ½–1 ft., 1–1½ lines wide, 5–7-nerved: scape 2–4 in. long: raceme lax, few-fld., 2–3 in. long: fls. drooping, violet-purple to lilac or more or less whitish. Jap., Corea, northern China. B.M. 1063.—Var. **variegàtus,** Hort., has variegated foliage.

AA. *Lower fls. in groups of 6–9.*

Jabùran, Lodd. Habit of the above, but more robust: lvs. 1½–3 ft. long, 4–6 lines wide, many-nerved: scape ½–2 ft. long: raceme 3–6 in. long: fls. white to lilac. Japan. L.B.C. 19:1876 (a fine pure white).—Var. **cæruleus,** Hort., has "blue" fls. Var. **aùreus variegàtus** has foliage striped golden yellow. Var. **argénteus variegàtus** has foliage spotted white. Var. **argénteus vittàtus** has foliage striped with white. W. M.

Ophiopogons are said to be hardy, but they are not reliably so. *O. Japonicus* lived for three winters in an exposed position on our rock garden, so that we felt inclined to believe it would continue so. One severe winter every plant died. *O. Jaburan* will occasionally live, but its foliage gets badly spoiled, so that we now lift it and store in coldframes. The variegated form, especially the one with blue flowers, is very ornamental. It may be used effectively in a variety of ways. It combines nicely with dwarf foliage plants in the make-up of mixed vases for parlor decoration. It has a permanent value, as after its new growth is made in springtime its variegation does not change nor its growth increase. Its leaves are leathery and durable, and thus it is effective the whole season. Spikes of blue flowers sent up in August add much to its beauty, combining most effectively with the yellow and green variegation. It is increased by divisions of the rhizomatous roots. Any soil and situation will suit it. We have had it do well in peaty soil and also in ordinary loam and shady corners, where scarcely anything else will grow. But, of conrse, the plants have been put out after their season's growth has been made in coldframes in spring.

T. D. HATFIELD.

ÒPHRYS (Greek, *eyebrow*). *Orchidàceæ.* A genus of terrestrial orchids mostly in the north temperate zone in Europe, Asia and N. Africa, the greater number being found in the Mediterranean region. They have the habit of Goodyera, bearing a basal rosette of lvs. with an erect flower stem terminating in a raceme or spike of fls. Sepals similar, spreading: petals smaller, often pubescent: labellum generally convex with incurved margins, not spurred, entire or 3-lobed: column short. Culture as for Habenaria.

The following are advertised by Dutch bulb dealers:

A. *Margin of the labellum brown or purple-brown.*

B. *Labellum scarcely longer than the sepal.*

C. *Sepals green.*

aranífera, Huds. SPIDER ORCHIS. Resembles *O. apifera.* Sepals green; petals very short; labellum dull brown, marked with paler spots, obscurely lobed. Spring and early summer. Europe. B.M. 5712. B.R. 14:1197.

fúsca, Link. Lvs. oblong-lanceolate, those on the stem narrower: sepals green, ovate-oblong, the upper one smaller, oblong; petals half as long, lanceolate-obtuse; labellum oblong, dark purple and hairy on the margin, disk light blue, polished. Mediterranean region. B.R. 13:1071.

CC. *Sepals rose-colored or white.*

arachnites, Lam. Stem erect, leafy: lvs. ovate-lanceolate: fls. distant; sepals ovate concave, rose-colored, tinged with green; petals conical, fleshy, smaller than the sepals and colored like them; labellum round, with the sides reflexed, black-purple, with yellow marks and green appendages. Cent. Europe. B.M. 2516.

apífera, Huds. (*O. arachnites,* Reichard). BEE ORCHIS. Stem 9–18 in. high, with few oblong or lanceolate lvs.: fls. 3–6, rather large; sepals ovate, pale pink or white; petals smaller, erect; labellum broad, convex, lobes all turned, velvety brown, marked with paler lines or spots. Fls. early summer. Dry pastures, Cent. and S. Europe.

BB. *Labellum longer than the sepals.*

Spéculum, Link. LOOKING-GLASS ORCHIS. Stem 4–12 in. high, 3–6-fld.: lvs. linear-oblong: fls. ½–1 in. across; sepals linear-oblong, green, with purple bands; petals very small, triangular-lanceolate, dark purple-brown; labellum quadrate, oblong, very convex; disk shining blue, with a yellow edge; margin pilose and fimbriate, maroon-purple. Mediterranean region. B. M. 5844. B.R. 5:370.

muscífera, Huds. (*O. myódes,* Jacq.). FLY ORCHIS. Stem very slender, 3–4-fld.: sepals oblong or narrowly

ovate, greenish; petals narrowly linear; labellum long, oblong, purplish brown, with pale white or blue marks in the center; central lobe notched. Spring and early summer. Cent. and E. Europe. R.B. 21:241.

AA. *Margin of the labellum yellow or greenish yellow.*

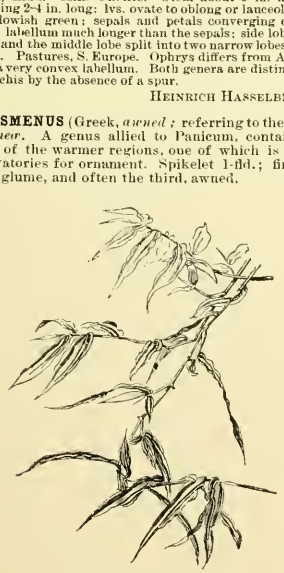
tenthredinifera, Willd. SAWFLY ORCHIS. Stem 6 in. high: lvs. elliptic-lanceolate: spike 3–8-fld.: fls. nearly 1 in. across; sepals oblong, obtuse, concave, varying from rose to white; petals very small; labellum broadly obcordate, greenish yellow, pubescent, with a large chestnut-colored spot on the disk. Mediterranean region. B.R. 3:205; 13.1093. B.M. 1930. F. 1872, p. 128.

lùtea, Cav. Stem 4–7 in. tall, many-fld.: lvs. linear-oblong: fls. ¾ in. across; sepals oblong, obtuse, incurved, green; petals much smaller, linear-oblong; labellum quadrate, golden yellow, with a purple disk. Mediterranean region. B.M. 5941.

Aceras anthropóphora, Br Advertised as Ophrys anthropophora, Linn. MAN ORCHIS. Stem about 9 in. high, the spike being 2–4 in. long: lvs. ovate to oblong or lanceolate: fls. dull yellowish green; sepals and petals converging over the column; labellum much longer than the sepals; side lobes long, narrow, and the middle lobe split into two narrow lobes. Early summer. Pastures, S. Europe. Ophrys differs from Aceras in having a very convex labellum. Both genera are distinguished from Orchis by the absence of a spur.

HEINRICH HASSELBRING.

OPLÍSMENUS (Greek, *awned;* referring to the awns). *Gramineæ.* A genus allied to Panicum, containing 4 species of the warmer regions, one of which is cult. in conservatories for ornament. Spikelet 1-fld.; first and second glume, and often the third, awned.



1542. Oplismenus Burmannii.

Bùrmannii, Pal. (*Panicum variegatum* of florists). Fig. 1542. A half-creeping perennial, with small, simple panicles, the common form with neatly white and pink striped leaves. Trop. Asia.—Popular for edges of beds and for hanging baskets. Propagated by divisions of the rooting stems. Gn. 47, p. 68. A. S. HITCHCOCK.

OPIUM is the product of *Papaver somniferum,* the common annual summer-blooming poppy of our gardens with smooth, glaucous leaves.

OPOPANAX. See *Acacia.*

OPÚNTIA (old Latin name used by Pliny, later used for the Indian Fig, thought by some to be derived from Opus, a town in Greece: by some authors the name is said to have been derived from a small port, Opus, in South America, from whence plants of the Indian Fig were early exported to the Old World). *Cactàceæ.*

Opuntia is a genus of great variation in habit and appearance, and, from the frequency of natural hybrids and ill-defined specific lines, one of the most difficult genera of flowering plants to satisfactorily present in systematic order. Opuntias vary from small, prostrate plants a few inches above the ground to trees with spreading tops 20 or more feet high. The stems are flat, clavate or cylindrical, and bear more or less elevated areolæ, from each of which appears a small caducous pointed leaf, rarely spreading and foliar. An oval or circular area, more or less covered with soft wool, intermixed with barbed bristles and usually a variable number of spines, occurs in the axil of each leaf. The flowers are borne singly toward the upper portion of the joints or stems, on the bristle-bearing part of the areola, and have spreading, showy corollas. The usually many-ovuled inferior ovaries are not of foliar development, and sometimes differ but slightly in appearance from normal stems. They are usually bristle- and spine-bearing. Fr. dry or succulent, frequently edible; seeds large, flattened, discoid and often margined. Some of the forms of Opuntias are seen in the illustrations (Figs. 1543–1549).

Some of the largest Cacti are Opuntias, while nearly all that are of economic value belong to this genus. The genus numbers about 130 species and many varieties and hybrids. It extends from British America southward through the United States, Mexico, West Indies and Central America to the southern portion of South America. The species are confined mostly to arid and semi-arid regions; however, some are found in regions of heavy rainfall. They are found in greatest quantity and variety of species in southwestern United States and northern Mexico, where they are often trees and form the most conspicuous part of the flora. A few species are extensively cultivated in warm regions for their large, edible fruits, while others are grown as hedges. Where introduced, many species have escaped from cultivation and become dangerous and troublesome weeds. Although the Opuntias are less attractive as pot-plants and, on account of their barbed spines and bristles, more difficult to handle than most other Cacti, they are coming into favor on account of their unique appearance, rapidity of growth and attractive fls. They grow best with an abundance of heat and sunlight, the character of the soil being a secondary consideration. Like all other Cacti, they require perfect drainage. They are readily grown from cuttings, and also from seed under proper management.

Economic Value.—Economically considered, the Opuntias are by far the most important of the Cacti. Although originally confined to the New World, the more important species are now in cultivation or have escaped from cultivation and become wild in every arid and semi-arid region of the globe where the temperature permits their being grown. Wherever grown, their tendency is to escape from cultivation and become persistent and troublesome weeds. In this respect they are much more to be dreaded in foreign countries than in America, the place of their nativity.

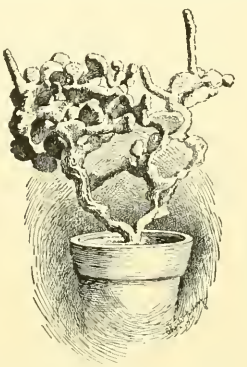
Ornamental Value.—As ornamental plants, Opuntias are unique rather than pleasing. From their stiff, formal aspect they do not harmonize, as a rule, with other plants, and on account of their spines and bristles they are difficult to handle and are considered by most gardeners as a nuisance in decorative planting. It is as hedges and as groups of mixed species that they are most effective.

Most species grow rapidly and bloom profusely. The fls., as a rule, are large and showy and of various colors, although yellow predominates. They soon wither after blooming and remain at their best only for a few days. The spines and bristles which usually cover the base of the fls. render them of no value as cut-flowers. With many species, such as *O. leptocaulis, O. tetracantha,* and some forms of *O. Tuna,* the bright-colored fruits, which remain on the plants for a long time after ripening, render them more attractive in fruit than in flower. Crested or fasciate forms (Fig. 1543) are common.

The Fruit of the Opuntias.—Although extensively cultivated for their fruit in many countries, where they furnish an important article of diet for 4–5 months each year, they do not as yet take a pomological rank with the

horticulturist, though they are much more widely used and of far more economic importance than many plants which have an established place in pomological literature. From the fact that Opuntias flourish best in regions where experimental horticulture receives little or no attention, the development of desirable economic varieties has not been what might be expected of plants which respond so readily to cultivation and selection, and which may be hybridized with so little difficulty.

Botanically considered, the fruit is a kind of berry, varying from dry to fleshy and succulent. Morpho-



1543. Opuntia ramosissima.
To illustrate fasciation, which is of frequent occurrence in nearly all species of Cacti.

logically, it is a modified stem with the true seed capsule sunken into its apex; hence it bears leaves and spines, and usually under suitable conditions and frequently in the natural state, when it becomes detached, will bud and grow like a normal stem-cutting.

History.—Opuntias were cult. by the aborigines of America at the time of its discovery, and were early taken by the Spanish explorers to Spain and Spanish colonies in other parts of the world. After becoming established in the Canaries, Azores, and Madeira islands, it was not long before their culture extended to Portugal, Spain and the whole littoral region of the Mediterranean. From there they spread to Egypt, India, and other parts of southern Asia. In comparatively later times they reached South Africa, Australia, and New South Wales, where they are fast becoming a serious menace to agriculture and grazing. In all the regions above noted they have escaped from cultivation and have become pestiferous weeds.

Varieties in Cultivation.—The want of fixed characters, the great variations in most species under different soil and climatic conditions, and the readiness with which natural hybrids occur, make the identification of cultivated and introduced species so difficult that the considerable literature on this subject is extremely uncertain as to nomenclature. The common names Indian Fig, Barberry Fig, Prickly Pear, and Tuna, are applied indiscriminately by most people to any flat-jointed Opuntias, but more particularly to the kinds with edible fruits.

The two most widely distributed and extensively cultivated are *O. Ficus-Indica* and *O. Tuna*. These plants have often been confused by authors. Much that has been written under the name of one species really applies to the other. They are closely linked together by hybrids, and each has been in cultivation for so long a period that numerous cultural varieties have developed, particularly in Mexico and Sicily. It is possible that the many cultivated forms of both species originated from the same source.

Although the Mexicans and Indians eat the fruit of more than a score of indigenous species, the two named above, with their many cultivated forms, are by far the most desirable and palatable. *O. Ficus-Indica* is preferable in most respects to *O. Tuna* on account of its fewer and smaller spines and usually larger fruit. The latter, however, makes a more formidable hedge, and is more frequently planted in the United States. Hedges of this plant are to be seen at many of the old Spanish missions in Arizona and California, where they were probably first introduced into the United States. *O. Ficus-Indica* is frequently grown by the Mexican population of New Mexico, Arizona and California. In southern Florida it has escaped from cultivation and become naturalized. The fruits are usually larger and fewer-seeded than in *O. Tuna*, and are commonly yellow. They frequently measure 3 or 4 in. in length and 2-3 in. in width. Forms of this species about the old missions of southern California vary considerably. One form, known as *Tuna Colorado*, has an insipid, light crimson-colored fruit, while another, *Tuna manse*, has a yellowish fruit, irregularly mottled with crimson.

The Fruit Economically Considered.—These two Opuntias, and possibly a few other closely allied ones, are extensively grown in Mexico. The fruit begins to ripen in June and July, while the later varieties last until December. The fruit is consumed by all classes and conditions of people. The fine bristles which invest the fruit are usually removed before picking by rubbing them with straw, grass or leaves. The fruit is later picked by the hand, or, in some instances, with wooden tongs. In large plantations, when the fruit is raised for commercial purposes, it is usually harvested with a heavy knife, the workman first cutting off the joint bearing the fruit, and later detaching the separate fruits.

In preparing the fruit for the table, a thin slice is cut from each end and a slit made through the paring, joining the cut surfaces. The thin paring is easily separated from the mealy but juicy pulp, and quickly removed with the fingers.

To-day the finest Opuntia fruits are grown in Sicily, where they are one of the most important crops that the island produces. From July to November the peasants live almost entirely on this fruit, and considerable quantities are yearly exported to other countries, some of which finds its way to New York and other American cities. It is grown extensively by the Arabs throughout northern Africa, and forms an important part of their food for a portion of each year.

Nutritive Value of the Fruit.—The nutritive value of this fruit ranks high, as shown by the following analysis by Wolff:

	Per cent
Dry substance	21.60
Ligneous matter	3.70
Proteid substances	.50
Fatty bodies	1.80
Sugar	14.

Yield per Acre.—It has been ascertained that some of the best varieties are capable of producing on lean, sandy or rocky soil, ill-suited for growing ordinary crops, as much as 18,000 lbs. of fruit per acre. When we consider that this is equal to 2,500 lbs. of sugar, as well as other valuable food constituents, it may be readily seen that the food value from the standpoint of nutrition is considerable.

Method of Culture.—Plantations are usually made on dry slopes of hills, as the plants do not thrive where there is much moisture or on heavy clay soils. Joints, cut or broken from the plants, are used instead of seeds, and are planted at distances of 6 to 8 ft. in furrows from 6 to 15 ft. apart. No tillage is practiced, as they grow rapidly, and in a few years shade and smother out all other growth. Before planting, the cuttings are exposed in half sunlight from seven to fifteen days, that they may partially wither, in order to facilitate rooting.

An important advantage in the culture of these plants is the regularity of the yearly crop. They begin to bear in about three years after planting, and continue in bearing for many years.

Of the Opuntias indigenous to the United States, none as yet have been grown for fruit, or with an effort to improve them. *O. Engelmannii* has a large but poorly-

flavored fruit, rarely eaten even by the Indians. *O. lævis* has one of the largest and most palatable fruits of any of the species found growing wild within the United States. This plant also has the advantage of having but few spines. *O. Camanchica*, *O. Rafinesquii*, *O. chlorotica*, *O. phæacantha* and *O. macrocentra* have medium-sized fruits, insipid and unpalatable to the cultivated taste, but eaten by Indians and Mexicans.

Wherever grown extensively, the Opuntia fruits are used for making a weak alcoholic drink. The juices of the highly colored sorts are sometimes used to color confectionery.

Opuntias as Forage.—Many of the Opuntias have considerable forage value, particularly during periods of long drought when other forage crops are short. The range cattle of the southwestern United States feed on either the branches or fruits, or both, of nearly all the indigenous species, the flat stems of *O. Engelmanni* and the pendulous fruit clusters of *O. fulgida* being most largely consumed. When cattle feed largely upon spiny Opuntias the spines and bristles often collect in their stomachs, forming large phyto-bezoars. During years of scarcity of other forage, thousands of cattle die in Texas, New Mexico and Arizona, where the cause assigned is starvation, when in reality the direct cause of death has been the perforation of the alimentary canal by the numerous spines of Opuntias.

In northern Africa the flat joints of the forms with few spines are used as forage for cattle during the dry season, after being allowed to ferment slightly. In Tunis, plantations are sustained by dairymen for the purpose of feeding their cows upon the fleshy stems.

O. Tuna has run wild to a remarkable extent in southern Africa. It has spread rapidly during the past century, and in many places has crowded out the grasses and become a nuisance. Two forms of the plant are recognized by the Dutch farmers; viz., a thorny variety growing on the open country and on stony hillsides known as Doornblad, and a fewer-spined larger variety with thicker stems known as Kaalblad. It is probable that these two varieties originated from the same introduction, for, according to Mr. Macdonald, the seed from the Doornblad or Kaalblad variety may give rise to plants resembling either or both of them. It is extensively used as feed for cattle, ostriches and pigs, either alone or when mixed with other forage. Here, however, much harm has come from range cattle eating it in times of little or no other forage, and ostriches become blind from the spines and bristles getting into their eyes in eating the fruits.

In New South Wales and Australia, where several species have escaped from cultivation and spread over large areas of arable land and driven out more valuable forage plants, the land has depreciated 50 per cent in value. Here, however, some of the worthless species, such as *O. vulgaris* and *O. monacantha*, are more widely spread than the more valuable varieties of *O. Ficus-Indica* and *O. Tuna*.

Possible Improvement of Present Varieties.—From what has been said it may be seen, first, that varieties of *O. Ficus-Indica* and *O. Tuna* produce large crops of edible and nutritious fruits; second, that plants with few or no spines are the general rule in *O. Ficus-Indica* and of not infrequent occurrence in *O. Tuna*; third, that Opuntias are strong, vigorous plants that will grow in situations in which few other plants will thrive; fourth, that spineless forms make valuable forage.

With these and more qualities to recommend them, it yet remains for horticultural enterprise to develop a spineless and bristleless variety that will not only be of value for forage but will produce large crops of fruits as attractive to the educated palate as to the savage. From the experience gained in establishing a garden of nearly 70 species and varieties of Opuntias, comprising about 300 plants, and watching their growth and behavior for several years, the writer believes that they offer great possibilities in the way of improvement in the hands of a careful plant-breeder.

J. W. Toumey.

Hardy Opuntias satisfy a rather general desire for something unique or grotesque, while at the same time they possess enough ornamental value to recommend them to everyone, and especially to those lovers of cactaceous and succulent plants whose space indoors is limited. Being natives of the western plains and foothills of the mountains, they can scarcely suffer from long-continued drought, and the sunny side of the rockery will suit them exactly, as it will allow all surplus moisture to drain off, and no artificial watering will be necessary. Mr. William Falconer, who has used large quantities at Schenley Park, Pittsburgh, Pa., writes as follows: "In certain localities, as on bleak, exposed banks and about rocky knolls, Opuntias and *Yucca angustifolia* can be used unsparingly with perfect success." He also says, "All have been planted out-of-doors, remaining unprotected summer and winter, and all have been perfectly hardy." They have succeeded also at Kew Gardens, in the very humid climate of England, without protection. Their requirements seem to be as follows: a porous, well-drained soil, a sunny exposure, and a season long enough in which to ripen the fruit and annual growth; these conditions being complied with, they will endure almost any degree of cold to be experienced even in the most northern portions of the U. S. Their altitude-limit in Colorado indicates that they will succeed as far north as Indian corn can be matured. The following kinds have been used successfully, as above indicated: *O. arenaria*, with small, round to oblong, very spiny joints, the spines varying much in color from gray and straw color to purplish brown. *O. arborescens*, the Tree or Candelabrum Cactus, the tallest of this list, is of cylindrical branching growth, with bright purple flowers and yellow fruit. *O. Camanchica* has very large, orbicular joints, the upper half thickly beset with spines, fruit purple. *O. fragilis* resembles *O. arenaria*, but is smaller. *O. mesacantha* includes a multitude of forms, all of which are very hardy. *O. phæacantha*, var. *major*, is one of the most striking sorts, with immense, glaucous joints, dark purple spines, yellow flowers, and purple fruit. *O. polycantha* is one of the most variable, as well as one of the most showy. The spines vary from ivory white to purple and brown, and from short and stout to long and slender. Nearly all the Opuntias have very showy flowers, usually in various shades of yellow and orange.

D. M. Andrews.

In the following synopsis it has not been possible in all instances to group the species so as to show relationships. A purely artificial key has not been attempted, as the species at best are separated by a great variety of characters. It will be seen that the list runs to 61 species, or practically half of all the known kinds. It will be noted, also, that a large part of the species in the trade are from Mexico and other southern regions. The Cochineal plant, often referred to Opuntia, must be sought under Nopalea. For the relationship of Opuntias to other cactaceous plants, and for additional hints on culture, see the article *Cactus* in Vol. I.

INDEX.

A. *Articulations or joints strikingly different, flat to cylindrical* ..... 1. **Brasiliensis**

AA. *Articulations or joints similar, more or less flattened.*

B. *Species from S. America* ... 2. **Galapageia**
3. **monacantha**
4. **aurantiaca**
5. **crinifera**

BB. *Species from N. America.*

C. *Joints pubescent* ..... 6. **microdasys**
7. **basilaris**
8. **puberula**

CC. *Joints not pubescent (except sometimes in O. pycnacantha).*

D. *Fruit fleshy or succulent.*

E. *Size of joints large: plants mostly large (O. crassa moderately small).*

F. *Color of spines white* ..... 9. **leucotricha**
10. **triacantha**
11. **candelabriformis**

FF. *Color of spines yellow (sometimes red to white in O. Engelmannii, polyantha, crassa, and Ficus-Indica.)*

G. *Spines none or few* .....12. **crassa**
13. **Ficus-Indica**

GG. *Spines always present, few to many. (One form of O. macrocentra has no spines, and occasional plants of O. chlorotica are without spines.)* .....14. **polyantha**
15. **Tuna**
16. **chlorotica**
17. **pycnacantha**
18. **Engelmannii**

FFF. *Color of spines reddish brown to black, usually with purplish joints* .....19. **phæacantha**
20. **Camanchica**
21. **macrocentra**
22. **nigricans**

EE. *Size of joints small: joints variable in shape: plants mostly low or prostrate. (Some forms of O. Rafinesquii have moderately large joints.)* .....23. **filipendula**
24. **Rafinesquii**
25. **vulgaris**
26. **Pes-corvi**

DD. *Fruit dry, more or less spiny* .....27. **ursina**
28. **bystricina**
29. **Missouriensis**
30. **rutila**
31. **arenaria**
32. **fragilis**

AAA. *Articulations or joints similar, more or less cylindrical.*

B. *Species from S. America.*

C. *Joints cylindrical, mostly elongated* .....33. **cylindrica**
34. **vestita**
35. **clavarioides**
36. **Salmiana**

CC. *Joints globose to broadly obovate* .....37. **Darwinii**
38. **diademata**

BB. *Species from N. America.*

C. *Spines without sheaths: plants mostly small, with clavate joints* .....39. **pulchella**
40. **clavata**
41. **Grahamii**
42. **Schottii**
43. **Emoryi**
44. **invicta**

CC. *Spines sheathed: joints cylindrical or nearly so, more or less elongated.*

D. *Number of spines variable, always more than one.*

E. *Fruit dry, usually spiny* ...45. **Davisii**
46. **acanthocarpa**
47. **echinocarpa**
48. **Bernardina**
49. **serpentina**

EE. *Fruit fleshy, proliferous* ....50. **prolifera**
51. **fulgida**

EEE. *Fruit fleshy, rarely proliferous* .....52. **Bigelovii**
53. **imbricata**
54. **arborescens**
55. **spinosior**
56. **Whipplei**
57. **versicolor**
58. **tetracantha**

DD. *Number of spines few, usually one, rarely more or wanting* .....59. **arbuscula**
60. **leptocaulis**
61. **ramosissima**

1. **Brasiliénsis**, Haw. A large, tree-like plant reaching a height of 15–18 ft., numerously branched, with a thick, roundish crown and an upright trunk, 4–6 in. in diam., and bearing numerous spines 1 in. or less in length: joints of two kinds, cylindrical, unarticulate, elongate ones and others which are shorter and much flattened and which arise as offshoots from the former; the latter leaf-like, thin, 2–6 in. long, oblong, rarely oblong-lanceolate or orbicular, dark green, margin angular, sometimes irregular: areolæ with short, gray wool and numerous brown bristles; spines usually 1, sometimes 1–3 small additional ones, 1–2½ in. long, mostly from the marginal areolæ, white, with brownish tips; fls. numerous, citron-yellow, 2 in. wide; fr. globose or ellipsoidal, yellow, about 1½ in. in diam. Brazil and southward.—One of the species most frequent in cult.

2. **Galapagéia**, Hemsl. An upright, tree-like plant 6–10 ft. high, with a circular, spreading crown and a very spiny trunk, 6–8 in. in diam., and light-colored bark becoming loosened and hanging in fragments from the older stems: joints elliptical to oblong, thick, 10–14 in. long: spines at first 3–4, spreading, flexible, increasing in number and size with age, finally covering the joints with long, brush-like bundles: fls. small, less than 1 in. wide, red: fr. subglobose, red. Galapagos Islands.

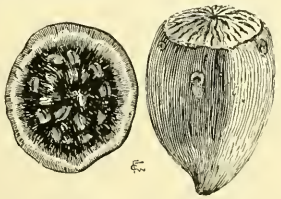
3. **monacántha**, Haw. An upright plant branching from the ground and reaching a height of 6 or more feet: joints oblong to elliptical, rather thick, terminal ones much thinner, 5–12 in. long, 3–6 in. wide, bright green: areolæ with uniformly short wool and yellowish brown bristles; spines 1–2, seldom more, erect, ¼–1½ in. long, yellow to dark reddish brown: fls. yellow, 3 in. wide: fr. ellipsoidal to pyriform, occasionally proliferous, red, somewhat spiny. Argentine Republic. —The horticultural variety **variegàta** is in the trade.

4. **aurantiaca**, Gill. A numerously branched, rather weak, semi-prostrate plant 3–5 ft. high: joints linear-lanceolate to lanceolate, 2–10 in. long, ⅓–1 in. wide, elliptical in transverse section, dark green, turgid: areolæ with a tuft of grayish white wool and bright yellow bristles; spines 4–6, spreading, straight, stiff, brown to yellow, the longest less than 1 in. in length: fls. yellow, 1½–2 in. wide: fr. carmine-red, globose, with short spines; seed with woolly hairs. Argentine Republic.

5. **crinifera**, Pfeiff. (*O. senilis*, Parm.). A much-branched, wide-spreading plant, about 3 ft. high: joints obovate to elliptical, 6 in. long and 3–4 in. wide, dark green, occasionally glossy: areolæ crowded, small, with white wool, numerous golden yellow bristles, and a variable number of long silky hairs: spines 6–8, later more, white, glistening, reaching 1 in. in length, the long silky hairs particularly developed on the under side of the young joints: fls. 3½–4 in. wide, golden yellow, often reddish. Brazil(?).

6. microdásys, Lehm. An erect, wide-spreading plant, rarely exceeding 3 ft. in height: joints elliptical to obovate, 3–4 in. long and nearly as wide, thick, bright green, densely pubescent: areolæ with short, whitish wool and numerous golden yellow bristles of variable lengths; spines wanting: fls. greenish to lemon-yellow, about 2 in. wide: fr. comparatively small, oval, less than 1 in. in diam., armed with numerous yellow bristles: flesh whitish. Northern Mexico southward.

Var. **rúfida,** K. Sch. Of more robust growth: joints rounder and larger, paler green, the bristles inclined to reddish brown. Mex.



1544. Fruit of Opuntia Ficus-Indica (× ½). No. 13.

7. basilàris, Engelm. and Begel. A low, spreading plant, rarely 1 ft. high: joints thick, variable, usually broadly obovate, with more or less truncate top and branching from the base, 4–7 in. long and 2–4 in. wide, bluish green, and very minutely pubescent: areolæ depressed, close together, and with brownish yellow wool and numerous short, yellowish brown bristles; spines wanting, rarely present: fls. dark purple, rarely white, 3 in. or more in diam.: fr. short, thick, green, becoming white and dry at maturity and filled with many large white seeds. Southwest U. S. and northern Mex.

Var. **ramósa,** Parish. A smaller plant, with joints branching from the upper end, and usually glabrous. S. Calif.

Var. **Trelèasii,** Coult. Differs from the species in having larger orbicular or obovate joints, with terete base, and larger leaves. S. Calif.

8. pubérula, Pfeiff. A numerously branched and upright plant, 2–3 ft. high: joints obovate or somewhat rounder, when young covered with very soft pubescence which becomes bright green with age: areolæ with short, brownish yellow wool and numerous short, amber-colored bristles; spines 5–7, 1 in. or more in length, straight, cylindrical, white, with amber-colored base, shining, the lower ones the longer: fls. 1½–2 in. wide, greenish yellow: fr. oval, 1½ in. in diam., the many areolæ bearing short wool and many bright amber-colored bristles; flesh sweetish; seeds many, correspondingly small. Mex.

9. leucótricha, P. DC. (*O. fulvispina,* Salm.). An upright, numerously branched plant, sometimes reaching the height of 10 ft.: joints elliptical or narrower, mostly rounded at the end, 8–10 in. long and half as wide, dark green: areolæ small, with white or whitish gray wool and numerous short brown bristles; spines very slender, mostly 4 at first, but later as many as 10–12; some reach the length of 3–4 in., becoming bristle-like and very flexible: fls. 2–3 in. wide, yellow, with reddish center: fr. spherical, 1–1¼ in. in diam., pale green to white, thickly beset with velvety wool and brownish yellow bristles; pulp sweet, edible. Mex.

10. triacántha, P. DC. An upright, tree-like plant, reaching 10–12 ft. in height: joints often very large, occasionally 18 in. long and 10 in. wide, obovate, thick, grayish green: areolæ remote, from 1¼–1½ in. apart, with short, grayish wool and yellow bristles; spines 3–4, white, with yellow points and bases, an in. or less long: fls. 2½–3 in. wide, carmine to orange-yellow: fr. elliptical, 1½–2 in. long; pulp acid. West Indies.

11. candelabriförmis, Mart. An upright, sparingly branched plant, 2–4 ft. high: joints elliptical to obovate, thick, dark green, 6–10 in. long and half as wide: areolæ with brownish white wool, later becoming gray, and numerous white bristles; spines 4–5, of which 3 are very strong, white, 1¼ in. or less in length: fls. 2½–3 in. wide, carmine-red: fr. spiny. Mex.

12. crássa, Haw. (*O. glaúca,* Hort.). A sparingly branched, upright plant, 4–6 ft. high: joints oblong to ovate, 3½–5 in. long and two-thirds as wide, glaucous, greenish blue, thick: areolæ with brownish wool, and few bristles of same color; spines usually wanting, sometimes 1–2 an inch or less long, straight and needle-like. Mex.

13. Ficus-Índica, Mill. Indian Fig. Fig. 1544. An erect, tree-like plant, reaching the height of 10–15 ft., and with a woody cylindrical trunk: joints elliptical or oblong, often with bluish bloom, thick, often 18 in. long and one-third as wide: areolæ orbicular and sparingly covered with white wool and yellow bristles; spines usually wanting, occasionally 1–2 small, weak ones are present: fls. yellow, expanding to 3–4 in. in diam.: fr. yellow, with reddish pulp, bristly, 2 in. in diam., edible. Mex. —A species widely grown throughout the warm temperate regions of the world. In some regions, escaping from cultivation, it has become a troublesome weed. Frequently cultivated for its fruit under the name of Indian Fig.

14. polyántha, Haw. A much-branched, spreading plant, 3 ft. or less in height: joints oblong to obovate, dark green, weak-spined, 4–6 in. long and 3–4 in. wide: areolæ with white wool and brown bristles; spines 3–8, slender, golden yellow, seldom over ¾ in. long: fls. 2½ in. wide: fr. broadly oval, deep red. West Indies (?). For var. **albispina** consult **O. Missouriensis,** No. 29, of which it is perhaps a form.

15. Tùna, Mill. (*O. hórrida,* Salm.). Figs. 1545, 1546. An erect, wide-spreading, tree-like plant, rapid-growing and frequently 10–12 ft. high: joints deep green, mostly elliptical, 10–14 in. long and 6–10 in. wide: areolæ with whitish wool which later becomes dirty gray, and a fascicle of long brownish yellow bristles; spines 4–6, rigid, stout, yellow, frequently subulate, spreading, unequal in length, 1–2 in. long: fls. 3–4 in. wide, yellow, fading to red: fr. pear-shaped or rounder, 1–1½ in. in diam., sweet, edible, dark reddish purple. West Indies and Mexico.—Probably the most extensively cultivated of all the Opuntias. Under the name of "Tuna" it has been grown in southwestern United States, West Indies and Mexico since the earliest Spanish possession. It is extensively grown both for its fruit and as a hedge plant. It has escaped from cultivation and become naturalized in North and South Africa, southern Europe, southwestern Asia and Australia, and in some places has become a troublesome weed.

1545. Opuntia Tuna. No. 16

16. chlorótica, Engelm. A compact, upright, moderately branched plant, from 3–6 ft. high, the trunk and main stems becoming woody and terete, and densely covered with long straw-colored bristles and spines: joints orbicular, somewhat glaucous, 6–10 in. in diam.: areolæ

crowded, with fine, gray wool and very numerous golden yellow bristles of unequal length; spines 3–6, rarely none, on old stems occasionally 40 or more, unequal, angular, golden yellow, deflexed, usually 1 in. or less long: fls. yellow, 2–3 in. in diam: fr. deep purple, moderately bristly, edible, 1½ in in diam., broadly obovate to globose; seeds comparatively small, sometimes sterile. Southwest U. S.

1546. Hedge of Opuntia Tuna. No. 15.

17. **pycnacántha**, Engelm. An upright, moderately branched plant, 3–5 ft. high: joints oval to orbicular, occasionally somewhat pointed at the ends, 4–8 in. long, sometimes pubescent, armed with a densely interwoven covering of mostly deflexed spines: areolæ crowded, approximately ⅛ in. apart, with dark brown wool and numerous long, yellow bristles; spines 3–7, on old stems 20 or more, straw-colored to ashy, mostly less than 1 in. long: fls. greenish yellow, 2–3 in. broad: fr. obovate, 1½ in. in diam. and covered with numerous spines and bristles. Lower Calif.

18. **Engelmannii**, Salm. Fig. 1547. An erect to semi-prostrate, profusely branching, coarse plant, 2–5 ft. high, forming large, impenetrable thickets, usually with a short, more or less terete, woody trunk, with grayish bark which becomes unarmed with age: joints broadly obovate to orbicular, pale to bluish green, very variable in size, in large specimens 12–14 in. long and nearly as wide, moderately thick: areolæ remote, about 1 in. apart, with gray wool and large, rigid, gray to yellow, unequal bristles; spines mostly 2–4, sometimes 1–3 small additional ones, very variable, horny, variously colored, mostly yellow, or white with reddish base, usually compressed or angular and curved or twisted: fls. yellow, red within, fading to red, 2½–3 in. in diam.: fr. broadly pyriform to globose, frequently 2 in. in diam., dark purple, with insipid purple flesh. U. S. and Mex.—This species, with its numerous varieties, is the most widely distributed and abundant of the large, flat-stemmed Opuntias in the United States. It varies greatly in different localities, and its many forms have not as yet been adequately defined.

19. **phæacántha**, Engelm. A diffuse, semi-prostrate plant, 1–2 ft. high, and freely rooting from lower margin of joints: joints broadly obovate, moderately thick, 4–6 in. long: areolæ about 1 in. apart, with short wool and reddish or brownish bristles; spines mostly toward margin or on apex of joints, 2–5, straight and stiff, reddish brown to almost black with lighter tips, 1–2½ in. long: fls. 2½ in. broad, yellow: fr. usually long-pyriform, 1 in. or less in diam. and twice as long, purple, with greenish acid pulp. Southwest U. S. and Mex.—This species and a number of the following become deep purplish green during autumn and winter. In the spring they lose their purplish color to a large extent and take it on again in the fall. The spines are also much darker in winter than in summer.

20. **Camánchica**, Engelm. and Bigel. A prostrate, widely spreading plant 1–2½ ft. high, and freely rooting at the lower margin of the joints: joints broadly obovate to orbicular, 4–6 in. long, moderately thick: areolæ about 1 in. apart, with light brown, short wool and yellowish brown bristles, mostly armed; spines very variable, usually 1–3, sometimes 3–6, on marginal areolæ, reddish to blackish brown with lighter tips, variable in length, sometimes 2½ in. long: fls. 2½–3 in. wide, yellow, with reddish center: fr. oval to globose, sometimes pyriform, deep red, sweet, edible, 1–1½ in. in diam. Southwest U. S.—Var. **gigantea** of the trade proves to be *O. phæacantha*.

21. **macrocéntra**, Engelm. A semi-prostrate, spreading plant, 2–3 ft. high: joints strikingly purple-green, very thin, broadly obovate to nearly orbicular, 5–9 in. in diam., with a few remarkably long spines on the marginal areolæ: areolæ about 1 in. apart, with grayish wool and short, grayish yellow bristles; spines rarely wanting, usually 1–2, reddish brown to almost black, annulate 3–5 in. long, slender and straight or variously twisted, sometimes 1–3 much smaller, lighter colored, secondary spines: fls. 3 in. wide, yellow: fr. oval to globose, rarely ovate, 1 in. in diam., red; pulp sweet, edible. Southwestern U. S., Mex.—This species is remarkable for its exceedingly long, dark spines and purple joints.

22. **nigricans**, Haw. A large, robust, upright plant, 2–5 ft. high: joints usually obovate, dark green, rarely tinged with purple, about 10 in. long and 6 in. wide, moderately thick: areolæ with short, grayish wool and yellowish brown bristles; spines 1–2, awl-shaped, 1–2 in. long, strong, dark brown, at first yellowish: fls. 1½–2 in. wide, yellow with red center. Mex.—Frequent in cultivation.

23. **filipéndula**, Engelm. A small, semi-prostrate plant, freely branching from the base of the joints, rarely 10 in. high and with thick, tuberous, moniliform roots: joints small and thin, bluish, glaucous, rarely 3 in. in greatest diam., orbicular to broadly obovate, sometimes diamond-shaped, frequently flattened at the top and broader than long: areolæ orbicular and with an abundance of whitish wool and many long, slender, yellowish green bristles, which are very conspicuous, particularly on the older joints; spines sometimes wanting, when present usually 1–3, rarely more, white, very slender and flexible, 1–2 in. long, mostly marginal: fls. yellow,

1547. Opuntia Engelmannii (×⅛). No. 18.

1½–2 in. in diam.: fr. clavate to narrowly obovate, 1½ in. long and half as wide, greenish yellow, with few seeds. Texas to Ariz., extending into Mexico.

24. **Rafinésquii**, Engelm. (*O. mesacántha*, Rafin.). A wide-spreading, prostrate plant, freely rooting from the lower margin of the joints, roots sometimes tuberous: joints obovate to orbicular, usually 2–5 in. long and 2–4

in. wide, sometimes twice as large, dark to light green: areolæ with gray wool and bright reddish brown bristles; spines sometimes wanting, when present 1–3 and mostly marginal, stout, 1 in. long, white with darker tips and bases, frequently 1–3 small secondary spines also present: fls. 3 in. or less in diam., golden yellow, frequently with reddish center: fr. slender-elavate or broader, 1½–2 in. long, yellowish red to purple, with insipid purplish pulp; seeds comparatively large. West central U. S.—An exceedingly variable species of wide distribution and imperfectly known. Many varieties have been described, some of which are in the trade. The extreme forms vary greatly from the type. Of these forms vars. **Greénii**, **oplocárpa**, **cymochila**, **stenochila** and **macrorhiza** have appeared in the trade. Hardy in Mass.

25. **vulgàris**, Mill. BARBERRY FIG. A diffuse, prostrate plant a foot or less high: joints usually resting on the ground and rooting from the lower margin, obovate to suborbicular, thick, 2–4 in. in greatest diam., pale green: areolæ with grayish wool and a few short, greenish yellow bristles; spines rarely present, when present usually 1, stout, erect, less than 1 in. long, yellow, often variegated: fls. 2 in. wide, pale or chrome-yellow: fr. obovate to spherical, 1 in. in diam., red, flesh insipid. Eastern U. S. Hardy in Mass.

26. **Pes-córvi**, LeConte. A small, diffuse, prostrate plant, rarely reaching 1 ft. in height: joints fragile, somewhat tumid, narrowly ovate to obovate or oblong, 2–4 in. long and less than half as wide, frequently much smaller, very thick, broadly oval in transverse section, bright green with a bluish tinge: areolæ circular, with short, whitish wool and a few short, slender, pale bristles; spines rarely exceeding 2, frequently none, slender, white, often brownish, less than 1 in. long: fls. yellow, 1½ in. wide: fr. obovate, bristly, purplish, 1 in. or less in diam; seeds comparatively large, very few. Florida.

27. **ursina**, Web. (*Grizzly-bear Opuntia*). Fig. 1548. An upright, diffuse plant, 1–2 ft. high: joints oblong to obovate, grayish green, thick, 3–6 in. long and 2–4 in. wide: areolæ with white wool and numerous yellow bristles; spines 12–20, reddish white, very slender and bristle-like, sometimes 4 in. long, frequently almost completely hiding the epidermis of the plant: fls. 2½–3 in. wide, reddish yellow. Calif.—Popularly known as "Grizzly Bear" Cactus.

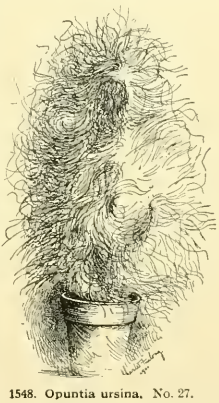
28. **hystricina**, Engelm and Bigel. A semi-prostrate, spreading plant, ½–1½ ft. high: joints obovate to orbicular, 3–5 in. long, moderately thick and very spiny: areolæ with grayish wool and yellowish red bristles; spines 10–15, 2 in. long or shorter, white or dusky, slender, flexile, angular and twisted: fls. light purple, 2–3 in. wide: fr. broadly obovate, 1 in. in diam., armed with many long spines. Southwest U. S.

29. **Missouriénsis**, P. DC. (*O. férox*, Haw. *O. spléndens*, Hort.). A prostrate, wide-spreading plant, rarely rising 1 ft. above the ground: joints variable, from elongate-obovate to orbicular, usually bright green, frequently wrinkled and tuberculate, 2–6 in. long: areolæ about ½ in. apart, with short, grayish wool and long, reddish brown bristles; spines 0–12, very variable in length, number and color on different forms and plants from different localities, mostly marginal, white or variously tinged with red or brown, slender, twisted and flattened, some reaching a length of 3 in.: fls. yellow, darker within, 2–2½ in. wide: fr. broadly ovate or subglobose, ¾–1 in. in diam., armed with numerous rather short spines; seeds comparatively large. West-central U. S.—A species of wide distribution and very variable, some high mountain forms entirely without spines, while other forms are armed with a close network of closely interwoven ones. A number of the forms have been segregated as varieties, of which the best known are **rufispina**, **platycárpa**, **microspérma**, **albispina** and **trichóphora**. All the forms appear to run together and the varietal distinctions are of doubtful value. Hardy in Massachusetts.

30. **rùtila**, Nutt. A low, diffuse plant, ½ to 1 ft. high: joints tumid, readily becoming detached, and covered with a close network of slender, interwoven, light gray spines, thick, elongate-ovate, 2–4 in. long: areolæ crowded, less than ½ in. apart, with short, white wool and yellow bristles; spines 3–5, sometimes a few short accessory ones, slender, reddish gray to white, with darker tips, 1¾ in. or less in length, larger ones often flattened and twisted: fls. red, 1½–2 in. wide: fr. broadly ovate to subglobose, usually armed with very long, interwoven spines; seeds comparatively large. Southwest United States.

31. **arenària**, Engelm. A diffuse plant with upright terminal joints, rarely reaching 1 ft. in height: joints thick, obovate, 2–5 in. long and half as wide, tumid, strongly tuberculate: areolæ crowded, ¼–½ in. apart, with sparse white wool and numerous yellowish brown bristles; spines very variable in number and size, 3–10, slender, flexible, white to ashy gray, usually 1 in. or less long: fls. yellow, 2–2½ in. broad: fr. ovate to globose, very spiny; seeds large and irregular. Southwest U. S.

32. **frágilis**, Haw. A small, prostrate plant, rarely more than 4 in. high: joints tumid, fragile, easily detached, oval, elliptical, or subglobose, 1–2 in. long and nearly as thick as broad, bright green: areolæ ¼–½ in. apart, with whitish wool and a few white to yellow bristles, which are much longer and more abundant on older joints; spines 1–4, occasionally a few small additional ones, weak, dark brown, the upper one usually longer and stronger than the others, rarely an inch in length: fls. greenish yellow, 1–1¼ in. wide: fr. ovate to subglobose, with few spines or bristles, mostly sterile, an inch or less long; seeds few and large. Rocky mountain region from British Amer. to New Mex.—Var. **brachyárthra**, Coult. A plant with more swollen joints, more numerous and stronger spines, smaller fls. and more spiny fruit. Colo., New Mex.



1548. Opuntia ursina. No. 27.

33. **cylíndrica**, P. DC. A moderately branched upright plant, 10–12 ft. high, with main stem 2–2½ in. in diam., new growth dark green, the comparatively long (½ in.) lvs. persisting for some time: areolæ depressed, with a little white wool, a few white bristles and some long white hairs: spines at first 2–3, erect, rather stiff, ½ in. or less long, at first whitish yellow, later grayish: fls. rose-red, 2–2½ in. wide from end of joints: fr. pyriform, 2–2½ in. long, yellowish green, somewhat spiny. Chile.—Var. **cristàta** is offered.

34. **vestìta**, Salm. A small, upright, numerously branched, ramifying plant a foot or more in height: joints rather short, 1–2 in. long and half as thick, usually dark green: areolæ with white to grayish wool and a number of long, rather soft, grayish white hairs; spines 4–8, either short, flexible and grayish yellow or four times as long (½–¾ in.), stiff and red: fls. 1–1½ in. wide, mostly lateral, dark red: fr. ellipsoidal, ¼–¾ in. long, bright red and covered with grayish wool. Bolivia.

35. **clavarioides**, Link & Otto. A low, numerously branched, spreading plant, 1–1½ ft. high: joints rather fragile and slender, ½ in. thick, cylindrical or somewhat clavate, frequently cristate, with numerous terminal, slender branches: lvs. extremely small: areolæ close together, small, with white wool; spines 4–10, sometimes fewer, very small and appressed, white: fls. 1–1½ in. wide and twice as long, greenish red: fr. elliptical, ½–¾ in. long; seeds with woolly hairs. Chile.—Var. **cristàta** is offered.

36. **Salmiàna**, Parm. A numerously branched, upright plant, about 3 ft. high, with very long, propor-

tionately slender branches: stems about three-fifths of an inch in diam., with rough, fissured or cracked, grayish brown or lead-colored bark, the terminal joints pencil-like, 3–10 in. long and ⅛–⅓ in. wide: areolæ on young growth with sparse white wool and few bristles, on older growth the bristles are very numerous and somewhat spine-like; spines 3–5, spreading, about ½ in. long, grayish: fls. 1 in. wide, red: fr. pyriform, 1–1¼ in. long, scarlet-proliferous, rarely fertile. Brazil.

37. **Dárwinii**, Hemsl. A small, numerously jointed, prostrate, ramifying plant a few inches high: joints globose to broadly obovate, 1½ in. in greatest diam., olive-green: areolæ with yellowish wool and few bristles; spines rigid, 1½–2 in. long, the lower ones shorter and darker: fls. only on top of terminal joints, 1–1½ in. wide, yellow: ovaries as large as the joints. Southern S. America.

38. **diademàta**, Lem. (*O. papyracántha*, Phil.). A low, moderately branched, spreading plant, rarely more than 4 in. high and forming dense patches several feet in diam.: joints 1–1½ in. long and nearly as thick, globose to broadly clavate, usually growing several in succession, one above the other, young growth bright green, soon becoming grayish: areolæ with abundant white wool and brownish black bristles; spines 1–2, papery, flexible, white or brownish with darker tips, one-fifth (?) in. long and half as wide: fls. rather small, pale yellow. Argentine Republic.

39. **pulchélla**, Engelm. A small, spreading, numerously branched plant, seldom more than 6 in. high: joints ascending, 2½ in. long and ½ in. thick, obovate to clavate: areolæ crowded, with white wool, and yellowish bristles which become more numerous and larger with age; spines 10–15, of variable length, the central one flattened, flexible, somewhat papery, 1 in. long: fls. from the top of the joints, purplish to rose-red, 1–1½ in. wide: fr. broadly clavate, 1 in. long, with long, hair-like, flexible white spines, dry. Nev., Ariz.

40. **clavàta**, Engelm. A low, spreading plant, 4–6 in. high, forming dense mats of ascending joints 4–5 ft. in diam.: joints 1–3 in. long and 1 in. thick, armed with numerous short, flat spines: areolæ with white wool and rigid, white bristles; exterior spines 6–14, white, ⅛–¾ in. long, interior 4–7, larger, flattened, scabrous and ⅛–1¼ in. long, 1 of the central spines usually very broad: fls. yellow, 1½ in. wide; fr. long-clavate, yellowish, dry, 1¼–1½ in. long, armed with many white radiating bristles. Nev., New Mex.

41. **Gràhamii**, Engelm. A low, spreading plant 4–8 in. high, with thick, fusiform roots: joints 2–3 in. long and ½ in. thick, armed with long, dark spines, bright green: areolæ with white wool and numerous long, yellowish brown, rigid bristles which become very conspicuous on old joints; exterior spines 4–8, ¼ in. long, interior 4–7, more rigid and longer (1½–2 in.), reddish to asby brown: fls. yellow, 1½–2 in. wide: fr. ellipsoidal, 1½–1¾ in. long and half as wide, armed with many large, radiating spine-like bristles. New Mex., Tex.

42. **Schóttii**, Engelm. A wide-spreading, prostrate plant, 4–6 in. high, with numerous short, curved branches; joints short-clavate, rarely more than 2 in. long and armed with numerous dark-colored spines: areolæ with white wool and very few bristles; exterior spines 6–10, very variable, ½ in. long; interior usually 4, flattened or irregular, 1½–2 in. long, brownish red: fls. greenish yellow to reddish, 1½ in. wide: fr. short-clavate, the numerous areolæ covered with white wool and many short bristles. Texas, Mexico.

43. **Émoryi**, Engelm. A prostrate and spreading plant with comparatively large, long-clavate, curved joints and reaching a height of 8–12 in.: joints 4–7 in. long and 1–1½ in. thick, with large, elongated tubercles: areolæ remote, with white wool and a few long (½ in.) yellow bristles; spines numerous, exterior 10–20, ¾ in. or less long, very bulbous at base; interior 5–10, brownish to reddish black, more or less flattened and sometimes 3 in. long: fls. yellow, reddish within, 1½–2 in. wide: fr. ellipsoidal, yellow, 2–2½ in. long and 1 in. wide, armed with numerous bristles and spines. Southwestern U. S., northern Mex.

44. **invícta**, Brand. A numerously branched, spreading plant, 10–14 in. high, bluish green and armed with many rigid, erect spines: joints 4–6 in. long and 2–2½ in. thick, nearly cylindrical: areolæ with whitish wool and yellowish red bristles; spines 15–25, exterior 6–12, ½ in. or less long; interior 10–15, very strong and rigid, 1–2 in. long, more or less flattened: fls. yellow, 1½–2 in. wide: fr. broadly obovate, dry, armed with numerous reddish spines and bristles. Lower Calif.

45. **Dàvisii**, Engelm. and Bigel. A procumbent, spreading shrub, with firm, woody skeleton, 1–2 ft. high: joints 4–7 in. long and ⅓–⅔ in. thick: areolæ with short, white wool and numerous straw-colored bristles; spines usually 8–13, exterior ½ in. or less long; interior 4–7, triangular, brownish, with lighter tips, ¾–1¼ in. long, very loose-sheathed: fls. greenish yellow, 2–2¼ in. wide: fr. clavate, 1 in. or more long, often sterile, spiny. Tex. to Calif.

46. **acanthocárpa**, Engelm. and Bigel. An arborescent, erect plant, 4–8 ft. high, with dense reticulate-tubular skeleton and ascending, spreading branches: joints usually 4–10 in. long, sometimes 20, and ¾–1 in. in diam.: areolæ with short, white wool and scanty bright yellow bristles; spines very variable in length and numbers on different plants, usually 8–25, 1½ in. or less long, with loose straw-colored or brownish sheaths: fls. greenish yellow, with reddish centers, conspicuous for stamens with stout red filaments, 1¼–1½ in. wide: fr. subglobose to pyriform, 1 in. in diam. and usually armed with many long, stiff spines. Ariz. and Calif.—A factory has been established at Tempe, Ariz., where the wood of this species is made into light furniture, picture frames, etc.

47. **echinocárpa**, Engelm. and Bigel. A low, spreading shrub, with reticulate woody skeleton, rarely exceeding 1¼ ft. in height: joints 1½–3 in. long, rarely 4–6 in., ¾ in. thick, somewhat clavate: areolæ with short white wool and a few coarse, straw-colored bristles: spines very variable in length and number, exterior 8–16, 1¼ in. or less long; interior usually 4 forming a cross, 1–1½ in. long, with loose white or straw-colored sheaths: fls. greenish yellow, 1¼–1¾ in. wide: fr. depressed-globose or hemispherical and armed with many long (1–1½ in.) spines on the upper areolæ. Utah, Ariz. and Calif.—The fruit of this species, like most others with dry fruit, ripens in the early summer, while most species with fleshy fruit do not mature them until fall or the following spring.

48. **Bernardina**, Engelm. A slender, branched, upright shrub, 3–5 ft. high, usually with several long, straight stems arising from the base: joints 4–24 in. long and ¾ in. thick, armed with numerous short spines: areolæ with grayish white wool and numerous yellow bristles; spines yellow or brownish, 8–14, usually with inconspicuous sheaths, ¾ in. or less long: fls. greenish yellow, 1–1¼ in. wide: fr. obovate, 1 in. long, armed with numerous rather short spines. S. Calif.

49. **serpentina**, Engelm. A prostrate, rarely ascending, sparingly branched shrub, a few inches to 2 ft. in height; joints much elongated, 6–20 in. long and ½–1 in. thick: areolæ with short, white wool and whitish bristles: spines comparatively short, usually 7–9, sometimes 15 or more, yellowish or rusty, ½ in. or less long: fls. greenish yellow, 1–1½ in. wide: fr. hemispherical, ½–¾ in. in diam., armed with numerous short spines and long woolly hairs. S. Calif., Lower Calif.

50. **prolífera**, Engelm. An arborescent, thick-stemmed plant, 3–8 ft. high, with numerous horizontal, spreading branches, the erect trunk sometimes 8 in. in diam.: joints short-cylindrical, rounded at the ends, very succulent, tumid and readily detached, bright green, 2–6 in. long and 1¼–2 in. thick: areolæ with white wool and on older joints with numerous straw-colored bristles; spines variable, usually 6–10, with conspicuous, loose, yellowish or rusty sheaths and much-barbed, usually about 1 in. long: fls. 1¼–1½ in. wide, greenish red: fr. subglobose, ¾–1¼ in. in diam., light green, with few small spines and bristles, pendulous in clusters, frequently sterile. Calif., Lower Calif.

51. **fúlgida**, Engelm. A numerously branched arborescent plant, often 10–12 ft. high, with erect trunk 8–14 in.

in diam., having a thick, grayish, scaly, unarmed bark: joints congested toward the ends of the larger branches, ovate to ovate-cylindrical, 2–8 in. long and often 2 in. thick, very fragile and tumid, easily becoming detached and taking root, bluish green, somewhat glaucous: areolæ with white wool and bright straw-colored bristles; spines on young growth 5–8, increasing yearly until ultimately 30–50, finally deciduous, with loose, glistening, white or straw-colored sheaths 1½ in. or less long: fls. ¾–1 in. wide, pink: fr. obovate to globose, light green, pendulous, in large, proliferous clusters, sometimes 50 in a single cluster. Southwestern U. S. and North Mexico.—The common "Cholla" of the Arizona plains, where it often becomes a fair-sized tree and notable for its formidable armor of barbed spines completely hiding the surface of the plant.

Var. **mamillàta**, Coult. Differs in having fewer, shorter spines.

52. **Bigelòvii,** Engelm. An erect, compact plant, 4–6 ft. high, rarely higher, with fragile woody skeleton which does not appear in joints of the first year's growth, the most densely spine-covered and diffient to handle of the cylindrical Opuntias: joints readily detached and forming formidable burs, ovate, short elliptical to long and cylindrical, with rounded ends, readily breaking from the plant and taking root, pale green, fragile, tumid, terminal ones frequently 3–5 in. long and half as thick: areolæ close together, with white wool and pale yellow bristles; spines 10–20, some very small, increasing in number as stems become older, straw-colored, loose-sheathed, 1 in. or less long, completely hiding the surface of the plant: fls. greenish red, 1 in. broad: fr. very spiny, ovate, 1¼–2 in. long and one-third as wide, few-seeded, mostly sterile. Ariz., Calif.

53. **imbricàta,** P. DC. A wide-spreading, irregularly branching shrub, rarely more than 5 ft. high, the trunk and larger branches with dark, rough, unarmed bark: joints frequently 12 or 14 in. long and 1–1¼ in. thick, with very prominent long, cristate tubercles: areolæ with yellowish wool and straw-colored bristles; spines 2–5, of variable length, 1 in. or less long, loosely sheathed, white to straw-colored: fls. 2–2½ in. wide, light purple: fr. unarmed, depressed globose, with large tubercles, yellow, 1–1½ in. in diam., adhering to the plant and drying on the stems during the winter. Tex. and northern Mex.—Usually confused with *O. arborescens*, from which it differs in its smaller growth, different habit, much longer joints, larger, more prominent tubercles, and fewer spines. The fruit and flower also show marked differences.

54. **arboréscens,** Engelm. (*O. stellàta*, Salm.). An arborescent, numerously-branched plant, 4–8 ft. high, with trunk of larger plants having very rough, dark, unarmed bark: joints with moderately prominent, narrow, cristate tubercles, verticillate, horizontally spreading on mostly pendulous, moderately spiny branches, mostly 3–6 in. long and 1 in. or less thick: areolæ with dirty-white wool and small yellow to light brown bristles; spines 6–20, variable in length, 1 in. or less, central ones more loosely sheathed, horny or reddish brown, white to straw-colored sheaths: fls. purple, 2–3 in. wide: fr. unarmed or with few spines, conspicuously tuberculate, subglobose, 1 in. in diam., yellow to yellowish red. Southwest U. S.—Frequently confused with *O. imbricata* and *O. spinosior*, intermediate between the two. Differs from the latter in having much larger, more cristate tubercles, fewer spines and different fruit.

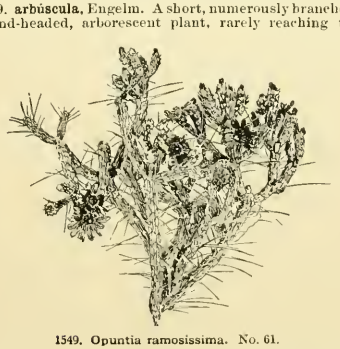
55. **spinòsior,** Toumey. A small tree, 6–12 ft. high, with numerous verticillate branches, forming a rounded head, the cylindrical trunk usually branching a few feet above the ground, and with rough, dark brown or grayish unarmed bark: joints verticillate and pendulous, ultimate ones usually 4–8 in. long and about 1 in. thick, dark green, frequently more or less purplish, with short, crowded rhombic tubercles: areolæ with white to reddish brown wool and usually few, small, variously colored bristles; spines 10–30, increasing in number yearly as the joints become older until finally deciduous, short, and rarely conspicuously sheathed, usually ⅛–¾ in. long: fls. showy, bright to dark purple, 2–2½ in. wide, in whorls at the ends of the joints: fr. elliptical to oblong, rarely obovate to globose, 1⅛–2½ in. long, yellow, frequently remaining on the stems during the second year. Ariz., northern Mex.

56. **Whipplei,** Engelm. and Bigel. A spreading, subprostrate shrub, rarely exceeding 2 ft. in height, with numerous ascending secondary branches, having short, crowded, prominent tubercles: joints variable, terminal ones elavate, 2–5 in. long and ⅔–¾ in. thick, mostly armed on upper half: areolæ with short white wool and a few short, light-colored bristles; spines white, very variable, on terminal joints, usually from 1–3 conspicuous loose-sheathed interior ones and several small, deflexed or radiating ones: fls. greenish yellow, crowded at the ends of the joints, 1–1¾ in. wide: fr. unarmed or with few spines, pyriform to subglobose, densely tuberculate, yellow or tinted with scarlet, ½–1 in. in diam., drying and remaining attached to the plant during the winter. Southwest U. S. and northwest Mex. —This plant is frequently confused with *O. spinosior*, probably from confusion in the original description.

57. **versícolor,** Engelm. A small, numerously branched tree, 6–10 ft. high, with rounded head and a short trunk, having smooth, light brown or reddish brown, unarmed bark: joints mneh elongated, usually 6–12 in. long, sometimes 20, ⅔–¾ in. thick, deep green, more or less colored with red and purple: areolæ with short gray wool and lighter colored bristles; spines variable, on terminal joints, usually from 5–13, older joints with 10–20, rarely, however, increasing in numbers after the second year, reddish brown, with inconspicuous, close-fitting sheaths, ¾ in. or less long: fls. bronze-colored, 1–1½ in. wide: fr. pyriform to clavate, of same color as joints, never yellow, sometimes tinged with red or purple, unarmed or with a few persistent short spines, 1–2 in. long. Ariz., northern Mex.

58. **tetracántha,** Toumey. An irregularly branching shrub, 2–5 ft. high, primary branches from a stout, upright trunk 2–4 in. in diam., and bearing numerous short lateral ones at irregular intervals: joints very variable in length, usually 4–10 in. long and ½ in. thick: areolæ with whitish wool and a crescent-shaped tuft of light brown bristles; spines 4, rarely more or less, ¾–1¼ in. long, stout, loosely sheathed, straw-colored, flattened, strongly deflexed, not increasing in numbers on older joints: fls. greenish purple, ½–1 in. broad: fr. obovate to subglobose, ½–1 in. long, juicy, scarlet, unarmed, or with a few stiff deflexed spines. Arizona.—One of the most attractive of the cylindrical Opuntias on account of its nmerous bright scarlet fruits.

59. **arbúscula,** Engelm. A short, numerously branched, round-headed, arborescent plant, rarely reaching the



1549. Opuntia ramosissima. No. 61.

height of 5 ft., but always with an upright, well-defined trunk, having rough, brown, unarmed bark: joints usually 2–4 in. long and ¼ in. wide, easily broken from the plant: areolæ comparatively large, with white wool and brush-like tufts of long, slender, yellow bristles: spines yellow, usually 1, frequently a small, slender, additional one at either side, ¾–1½ in. long, loosely sheathed: fls. bronze-colored, ¾–1 in. wide: fr. unarmed, of same color

as joints, long, clavate, 1–2 in. long and one-third as wide, mostly sterile, fertile ones with a few remarkably large, irregular-spheroidal seeds. Arizona, Sonora.

60. **leptocaulis,** P. DC. (*O. frutéscens,* Engelm.). An erect shrub, 2–4 ft. high, with long, slender, flexible stems branching from near the ground, and numerous lateral secondary ones, very short, usually unarmed and easily detached: joints about one-fifth to ¾ in. thick: areolæ with short, white wool and numerous, reddish brown, conspicuous bristles: spines usually 1, sometimes wanting, erect, stout, frequently 2 in. long, brownish or horny, with a loose yellow sheath: fls. greenish yellow, ⅜–¾ in. wide, with deflexed perianth: fr. scarlet, succulent, obovate to oblong, rarely globose, ½–⅔ in. long, frequently proliferous, armed with tufts of long, reddish brown bristles. Southwestern U. S. and Sonora. Var. **major,** Hort., is advertised.—One of the slenderest of the Opuntias. It differs from other species in that the fls. do not open until late in the afternoon. Several forms of this plant occur throughout its range, some of which have been separated as varieties. One of the most frequent of the cylindrical Opuntias in cult.

1550. Orange (Satsuma).
Showing the multiplication of locules or compartments.

61. **ramosissima,** Engelm. (*O. tessellàta,* Engelm.). Figs. 1543, 1549. A spreading bush, 2–5 ft. high, with numerous slender branches arising from a short trunk, 1–3 in. thick, and having dark, scaly bark: joints ashy to bluish gray, variable in length, ultimate ones 2–6 in., ¼–½ in. thick: areolæ with sparse white wool and a few small yellow bristles: spines sometimes wanting (Fig. 1537), usually 1, stiff, erect, 1½–2 in. long, loosely sheathed: fls. reddish purple, ½–⅔ in. wide, dry, narrowly obovate, 1 in. long, ⅛ in. wide, with 1 or 2 seeds, frequently sterile, armed with numerous long, grayish bristles. Ariz., Calif., Sonora.

O. coccinellífera, Mill.=Nopalea.—*O. corrugàta,* Salm., is advertised, but little known.—*O. glaucophýlla,*—*O. Kleiniæ,* DC. is also advertised.—*O. lúrida* is probably O. arborescens.

J. W. Toumey.

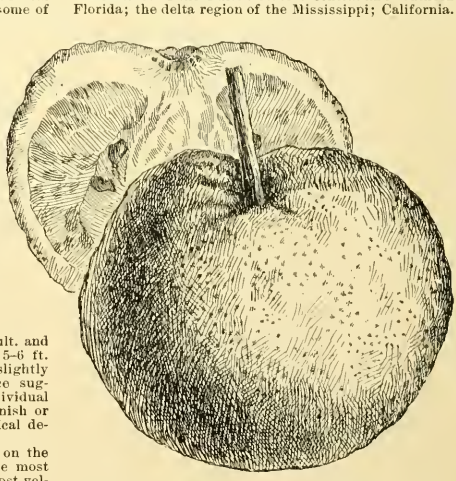
ORACH, or French Spinach, is a pot-herb cult. and used much like spinach. It is an annual, grows 5–6 ft. high, has furrowed stems and arrow-shaped, slightly crimped lvs. of soft texture. The inflorescence suggests that of amarantus-like plants. The individual fls. are very small, devoid of petals, and greenish or reddish according to variety. For a more technical description, see *Atriplex hortensis.*

There are three main types of Orach, based on the color of the lvs. The white variety is the one most commonly grown. The lvs. are pale green, almost yellow. The red or dark red variety has stems and foliage of dark red color, which disappears in cooking. It is occasionally cult. as an ornamental foliage plant under the name var. *atrosanguínea.* The green variety is perhaps the most vigorous type. The lvs. are rounder than those of the white var. and less toothed. So far as is known, only the red and white varieties are offered in America. The seed is usually drilled into the open ground in early March. The plants are used in their young state. They bear hot weather fairly well, but soon run to seed. Monthly successional sowings are therefore desirable. Orach is little known in America.

W. M.

ORANGE. Plate XXIII. The Orange is one of the oldest of cultivated fruits. Its nativity is still in doubt, but it is probable that it is indigenous to the Indo-Chinese region. It is now widely distributed in all warm-temperate and tropical countries, in many of which it has run wild and behaves like a native plant. In parts of Florida the Orange was found wild when permanent settlements were made, but it had probably spread from stock that was introduced by the early Spaniards. In stature of tree and character of fruit, the Orange has varied immensely. Normally, the fruit contains ten compartments or locules; but under the influence of domestication these compartments have been increased, and in some cases a secondary axis, with its accompanying locules, has been thrust into the center of the fruit, causing the "navel" appearance of some varieties. Fig. 1550; also Fig. 476, p. 322. These navel Oranges, of which the Washington Navel or Bahia is the best known, are chance seedling varieties, as other varieties are. The immediate cause of this particular kind of variation is unknown. The Washington Navel was introduced from Brazil in 1870 by the late Wm. Saunders, of the U. S. Dept. of Agric., and by him distributed as the Bahia (see Van Deman, Rept. Dept. Agric, 1886, p. 267). In recent years, some of the odd and grotesque types of Japanese Oranges have been introduced into this country, but they will probably always be curiosities rather than commercial pomological products. See Figs. 1551–2 and cf. Shinn, A.G. 1890, 333–6.

There are three well-developed Orange regions within the confines of the United States: central and southern Florida; the delta region of the Mississippi; California.



1551. The Natsu-dai-dia, or Summer Orange of Japan.
The fruit is large, suggesting a shaddock. It is not eaten till the second summer.

Parts of Texas and the Mexico-Arizona region will no doubt develop into commercial Orange sections in the near future. Until within recent years a large part of the Oranges consumed in this country have come from

Orange tree in flower and fruit

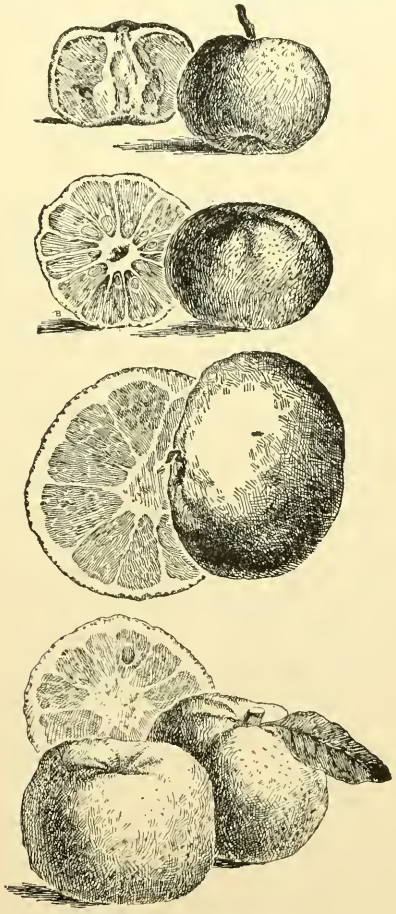
Mediterranean regions, but the Florida Orange has taken the place, to a large extent, of the imported fruit. Since the great Florida freeze of 1895, however, the California Orange has come to be much better known in the eastern states.

Fifty years and more ago, Oranges were commonly grown under glass in England and parts of the continent. At that time there was no rapid transportation between the Orange-growing regions and northern countries, and the Orange fruit was a luxury. Special houses, known as orangeries, were devoted to the culture of the fruit. The trees were ordinarily grown in large tubs or boxes (Fig. 1553), and were kept in the open in summer and were placed in the orangery in winter. These orangeries were scarcely greenhouses in the modern understanding of the term. In many cases they had slate or shingle roofs, the sides only being provided with an extra amount of glass in the shape of windows. Some of them, however, were houses with glass roofs. As imported Oranges came to be more common, these Orange houses gradually fell into disuse. It is doubtful if there are any of these establishments now standing in this country, but one sees them occasionally in Europe. As the Orange trees disappeared, other plants were grown in the house, so that an orangery came to mean a particular kind of house in which plants are grown that will thrive in conditions suited to the Orange. It came to be no uncommon thing to see orangeries in which there were no Oranges.

The Orange tree is still a popular subject in conservatories, however, and in window-gardens. In the latter conditions it rarely produces fruit of any consequence, but the shining evergreen foliage and the very fragrant flowers make the plant interesting and desirable. The plant is subject to scale and mealy bug, and constant attention must be given to syringing and sponging the foliage. The leading difficulty in the growing of an Orange tree in the dwelling house is a tendency to keep it growing the entire year and to keep it too wet at the roots. After the fruiting season, in late fall or early winter, the plant should be allowed to rest for a time in order to harden its wood for the next year's bloom. It may then be kept at a temperature of 40° to 50° and fairly dry at the roots. Water should not be withheld entirely, however, because the plant should be kept in such condition that the foliage will not drop. After a period of relative inactivity of one or two months, the plant may be set in a sunny place and given a somewhat higher temperature, and water and liquid manure may be applied at the roots. It should be in bloom during the summer and early fall. Best results are secured if the roots are somewhat confined. When the plant is small, it may be potted on from time to time; but after it has attained the height of five or six feet, it should not be given more root room than a small tub or a half barrel. Ordinarily, it will not need repotting for several years at a time after it has attained this size. Some of the surface soil may be removed from time to time and fresh soil added and liquid manure applied. Usually the stocks which are used are grown from seeds, and the plants vary as peaches or apples do. Some of the plants may give desirable fruit, but the larger part of them will give fruit of indifferent or even inferior quality. If the best kind of fruit is wanted, the young plants should be budded after they are well established in the pots. Buds may be secured from any tree that bears a desirable fruit, or they may be obtained from the South.

In recent years the Otaheite Orange (described in Vol 1, page 323) has come into prominence as a pot-plant. Fig. 1554. It is a dwarf form of the common Orange species. It is undoubtedly the best form of Orange for growing in the house. The fruits are small and handsome, and the flowers have a pinkish tinge and are very fragrant. These plants will bloom and bear when not more than a foot high if the roots are somewhat confined or the plants not overpotted. Usually they will bloom the greater part of the year, but, like most hard-wooded plants, the best results are secured if they have a period of rest, as described above. The temperature for all Oranges should be relatively low; that is, it should be the temperature of the intermediate house or one which will grow carnations, chrysanthemums, geraniums, and the like.

There is much literature on the Orange, but there is no full and comprehensive treatise on Orange culture in North America. An authoritative general work on Oranges is Risso and Poiteau, "Histoire et Culture des



1552. Japanese types of Orange.

Top, Sakura-jima, small, dwarf in growth, coarse in quality. Second from top, Shiriwa-koji, sweet and solid, of good quality, the rind thin and yellow. Oonshiu or Satsuma, one of the "kid-glove" class. Kawachi, also a "kid-glove" Orange.

Oranges," Paris. On the oriental forms and histories of Oranges, one should consult Bonavia, "The Cultivated Oranges and Lemons of India and Ceylon," London, 1890. The American books on the Orange are as fol-

lows: Garey, "Orange Culture in California," San Francisco, 1882; Moore, "Treatise of Orange Culture in Florida, Louisiana and California," New York and Jacksonville, Third Edition, 1883; Manville, "Practical Orange Culture: including the Culture of the Orange, Lemon, Lime, and other citrous fruits as grown in Florida," Jacksonville, 1883; Spalding, "The Orange: Its Culture in California," Riverside, 1885. One should also consult Wickson's "California Fruits," and the publications of the California State Board of Horticulture.

For an account of the Orange from the botanical point of view, see *Citrus*.

L. H. B.

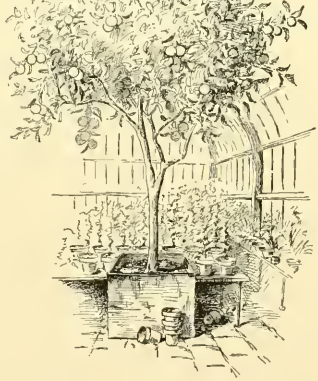
Orange Culture in Florida.—The foundation of Orange culture in Florida was laid, it is believed, by the accidental distribution of sour Orange seeds by the Indians, who obtained the fruit from trees planted by the Spaniards in early days, and which were probably grown from imported seeds.

These sour Oranges were carried from camp to camp, and the seeds thus scattered through the northern and central parts of peninsular Florida found congenial soil and conditions in the open hardwood forests and live-oak groves of that region, and in time formed wild groves of great extent, always in places where more or less protected from sun and radiation by towering live-oaks, magnolias and similar trees.

Sweet Oranges were grown to some extent for family use even before the civil war, but in the absence of transportation facilities were considered of no commercial value.

Between 1865 and 1870, however, the Orange trees along the banks of the St. John's river began to attract attention as a profitable investment, and a little later an enterprising horticulturist bought a portion of a wild grove in the interior, near Orange Lake, and budded the tops of the sour trees to sweet varieties. The profits were prompt and large, so much so that this pioneer, who began with an investment of only $1,000, had a crop valued at $231,000, for the year of the great freeze, 1894–5.

Many of these wild groves were injured or destroyed, however, by the removal of the protecting live-oaks,



1553. Tub-grown Orange tree.

and being located on about the 30th parallel of latitude, the Oranges themselves had to be marketed early in the season to avoid destruction by frost. By 1880 cultivated groves spread over all parts of Florida where railroad or steamboat transportation was accessible; the Indian river hammocks being justly celebrated for the quality and abundance of the fruit, while almost every kind of soil and exposure had its champions as best for Orange culture. The winters for several years prior to

1554. Otaheite Orange in a pot.

1880 were almost frostless, and the rains abundant all the year round, so that the growth of well-cultivated young groves was phenomenal, and the whole northern half of peninsular Florida gave itself up to Orange culture with reckless enthusiasm—it was estimated that the Orange at 12 years of age would pay from 10 to 150 per cent interest on a valuation of $100 for each tree, and in the case of individual trees even the highest figure was sometimes realized.

The first check to this state of affairs was received in 1886, when a three days' blizzard from the northwest swept over the state and cut back or at least defoliated all the Orange trees down to the 29th degree, and still further south in all but the most protected stations. This injury, however, was only temporary in most cases, and while much of the crop of 1885–6 was lost, there was no diminution in the crop of the following year, although the trees themselves had received an evident check.

From 1886 on, there has been a succession of frosts, generally not sufficient to hurt old trees but enough to destroy or seriously cripple nearly all the young groves north of the latitude of Tampa, so that few, if any, new groves have been brought into successful bearing north of that point since 1886.

In December, 1894, a still more severe northwest blizzard defoliated all the trees as far south as the Manatee river, and this was followed in February by another similar freeze, which caught the trees covered with tender shoots and young foliage, with active sap, and killed most of them to the ground from Tampa north, and, moreover, so enfeebled them from the repeated shocks that the majority were unable to rally, and are to-day either dead or worthless. The loss to the Florida Orange industry by this double freeze is reasonably estimated at $100,000,000.

The crop of 1894–5 was the largest hitherto produced, and estimated at 6,000,000 boxes, each of 2 cubic feet. The following year about 75,000 boxes were produced, all from south of the latitude of Tampa, and the crop has been increasing till that of 1900–01 is estimated at 1,000,000 boxes, 95 per cent of this coming from regions south of Orange county, which just about reverses the proportion observed "before the freeze."

The following table was supplied by Mr. E. O. Painter, editor of the "Florida Agriculturist," after consultation with the officers of the Florida Fruit Exchange, and may be relied on as substantially correct:

FLORIDA ORANGE CROPS.

	Boxes
1884–85	600,000
1885–86	900,000
1886–87	1,260,000
1887–88	1,450,000
1888–89	1,950,000
1889–90	2,150,000
1890–91	2,450,000
1891–92	3,761,843
1892–93	3,400,000
1893–94	5,055,367
1894–95	6,000,000 (Est.)
1895–96	100,000
1896–97	250,000
1897–98	216,579
1898–99	225,000
1899–1900	400,000
1900–1901	1,000,000 (Est.)

Many groves in Orange county and northward have been brought into fair condition by banking the trunks with earth during the winter so as to limit the injury by frost, and if another series of frostless winters like those between 1870 and 1880 were to occur, these groves, with others newly planted, would gain sufficient age and size to defy the ordinary frosts and make this region again productive. Many acres have recently been shedded over with slats or canvas—usually removed in summer—and, thus protected from the cold, are promising large returns on the heavy investment required to build the sheds—from $600 to $1,000 per acre. Figs. 1555–6. They are usually heated during the coldest nights, either with open wood fires or stoves burning coke or coal. The most extensive shedding operations are those of John B. Stetson, of Deland, who has 37 acres covered, various systems of protection being employed on different plots.

1555. Movable shed to protect an Orange tree from cold.

It has a board top and cloth sides. The sides can be removed, allowing the trees full light.

The Orange has been grown on the most varied soils in Florida, but successful groves have been mainly on "high hammock" and "high pine," and the greatest profit, as a rule, has been from the hammock groves, where seedling trees came into bearing much earlier than on pine-land, and both seedling and budded trees produce more abundant crops.

The Orange groves of California and Arizona are subjected to greater winter cold than those of Florida, but suffer comparatively little damage from it, since the winters are more uniformly cool and dry and the trees are consequently dormant, while the usual warmth of a Florida winter keeps vegetation constantly in more or less active growth, and hence more sensitive to sudden frosts. Thus in 1894–5 not only Orange trees but peach and mulberry trees and old Wistaria vines—all hardy as far north as Canada when dormant—were frozen to the ground. The mean temperature has changed little, if at all, during this alternation of mild and frosty cycles of years; indeed, the mean of maximum and minimum observation taken daily at Mount Dora, Fla., for six comparatively frostless years prior to 1886 was half a degree F. colder than the mean of six years of injurious frosts subsequent to 1886.

The Orange tree is a gross feeder, and in the sandy soils best adapted to its culture in Florida can use to advantage large amounts of commercial fertilizer, provided the ammonia is balanced by abundant potash and care is taken to avoid an excess of crude fermentable materials containing nitrogen, such as cottonseed-meal and dried blood.

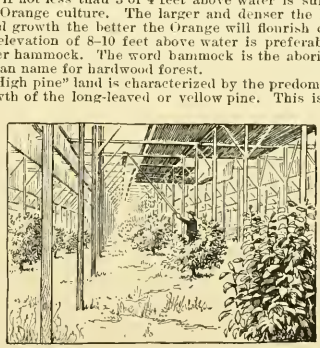
On the moister grades of hammock land, such, for example, as those bearing the fine groves near the Manatee river, it is considered unsafe to give more than 10 pounds of commercial fertilizer a year, even to the oldest bearing trees, on account of its liability to produce disease; and additional sulfate of potash is used, even with standard brands of fertilizer rich in potash. On the high pine-land at Deland, profit has been found in applications of 80 pounds to the tree, or 2 tons to the acre, but the average amount used by successful growers is 20 to 30 pounds to the tree of special brands, costing from $30 to $37 per ton.

So long as the soil is not unduly depleted of humus, frequent cultivation is an important factor in producing rapid growth of Orange trees. As an experiment, a seed was planted and hoed every day except Sundays for four years. It was then about the size of an average eight-year-old tree in the region—one celebrated for its fine and fast-growing Orange groves—and bore four boxes of Oranges—about what would be expected from an eight-year-old seedling in that place.

Soils.—The surface soils of peninsular Florida are almost wholly of subaërial origin—that is, are composed of particles cast up by the waves of the sea and carried to their present positions by the wind. The process may be observed at the present day in some places on the coast, for example, where a gentle slope inland from the beach ends in a thicket of underbrush and small trees. At such a place the slope abruptly ends at an angle of 45 degrees, and whenever a breeze blows from the sea on a dry day a continuous stream of sand may be seen blowing over the crest and falling down the steep angle, gradually engulfing and burying the thicket in a layer of sand sometimes 15 feet in depth. The trees and bushes form a wind-break and thus check the blowing of the sand towards the sea when a land breeze prevails. As might be expected, the elevations in peninsular Florida are small, the highest point of the peninsula being but 300 feet above the sea-level.

The result of long ages of wind action on a soil composed wholly of fine particles has been to assort these articles according to weight and size and other physical characteristics into innumerable patches, small and great, each of which has its own peculiarities in its reaction upon the vegetation which it bears. This makes the soil capabilities of any tract of land a bewildering puzzle to the newcomer, and the only certain clue to its solution is found in the character of the vegetation already growing on it. Chiefly in accordance with this natural growth, the soils are classified as high hammock and low hammock, high pine and low pine, or flatwoods, prairies, scrubs, bays and shell-mounds. Any land bearing an abundant growth of hardwood trees—live-oaks, hickories, magnolias, etc., is hammock land, and if not less than 3 or 4 feet above water is suitable for Orange culture. The larger and denser the hardwood growth the better the Orange will flourish on it. An elevation of 8–10 feet above water is preferable to lower hammock. The word hammock is the aboriginal Indian name for hardwood forest.

"High pine" land is characterized by the predominant growth of the long-leaved or yellow pine. This is also



1556. One method of protecting Orange trees in Florida.—A slat shed.

suitable for Orange culture; the larger the pines the better the land. If the pines are intermixed with willow-oaks and an occasional hickory and cabbage palmetto, the land is sometimes called half-hammock, and such land is more fertile than ordinary pine land. Blackjack oaks, on the contrary, are an indication of poverty of soil.

As fires sweep over the pine lands annually, burning the resinous pine straw, there is a good deal of finely divided charcoal in these soils but very little humus, while in hammock soil the percentage of humus is often very large.

Flatwoods (low pine land) is characterized by several small-coned species of pine, which otherwise very much

1557. Florida Orange grove.

resemble the long-leaved pines. This land is often underlaid with hardpan a foot or two below the surface. Much of it is subject to overflow in the rainy months, and when overgrown with gallberry bushes it is useless for Orange culture.

A prairie is a tract in the flatwoods overgrown with grass only and covered by standing water during a part of each year.

A scrub is a tract of white sand—often like clean granulated sugar—overgrown with dwarfed live-oaks and other bushes, mostly of the heath family and usually only a few feet high, with scattered spruce-pine trees, the open spaces often covered with reindeer moss and allied lichens. It is entirely worthless for Orange culture, though suited for pineapples if richly and constantly fertilized.

A hay or bayhead is a deep accumulation of humus—muck and peat. When drained, such lands make the best vegetable gardens.

The shell-mounds are, as their name implies, accumulations of the shells of marine or fresh-water mollusks, intermixed with a little sand and humus. They are apt to be thirsty, though fertile when plenty of water is supplied, and although the Orange will grow upon them and produce fine, silky-skinned fruit, the trees are not long-lived, as a rule, and seem subject to disease. The finest silky-skinned fruit is rarely, if ever, produced by trees in vigorous health and rugged growth.

The tendency of Orange trees on pine land, especially bottomless pine lands—those not underlaid with clay—is to wood growth, and the postponement of abundant fruiting till a great age has been reached; this is especially the case with seedling trees. The coarser the pine land soil in texture, the longer, as a rule, will the Orange tree take to reach a bearing age, sometimes requiring twenty or thirty years, even with abundant fertilizing, on the coarser sands. On the hammocks, seedlings fruit at a much earlier age, and budded trees often dwarf themselves from overbearing.

South of the 27th degree of latitude there are some rich, red, loamy soils, while the sand consists largely of coral debris instead of quartz. In these southern regions the Orange is supposed to flourish only upon the scrub lands, being dwarfed and subject to disease on the otherwise rich and fertile red soils.

When not injured by frost, the Florida Orange tree is immensely productive of thin-skinned delicious fruits. A good Florida orchard or grove is shown in Fig. 1557. A new tree arising from the stump of a frozen tree is shown in Fig. 1558. Many groves have been renewed in this way.

Varieties. — Of the leading varieties, Homosassa may be taken as the type of the finest seedlings originating in Florida; other Florida seedlings have been named, but they are much alike. Jaffa and Majorca are typical of the best thornless foreign varieties; the Washington is the only navel Orange sufficiently productive to warrant planting in Florida, where none of the navel Oranges are as prolific as other sorts. Of the kid glove Orange, the Tangerine has quite displaced the Mandarin in Florida, the brighter color of the former always ensuring a higher market price. Satsuma has the merit of being earlier than the Tangerine and possibly being hardier, hence is largely planted, though not equal in appearance or quality to the Dancy Tangerine. Of the two varieties of Kumquat or Cherry Orange, the "oblong" is the best market fruit, the "round" being too variable in size and often too small.

THEODORE L. MEAD.

ANOTHER VIEW OF ORANGE CULTURE IN FLORIDA.— In primitive Orange culture the tree was a seedling from selected fruit, and even at this time the majority of bearing trees in Florida are seedlings. Seedlings are late in coming into bearing, their fruit is of variable quality, and the roots of sweet Orange trees are likely to get the "foot-rot," or *mal-di-goma*. Therefore growers are now more careful as to stocks used and seldom plant the sweet seedling tree, but graft or bud on more suitable roots. On very high land of best quality which is deeply drained, it is possible to raise the sweet seedling without great danger from foot-rot. As long as the roots are healthy the trees produce fruit in abundance, and many growers contend that the fruit produced, whether of Orange, lemon or pomelo, on sweet Orange stocks is better in quality of juice, has less "rag" and a thinner skin, and hangs on the tree in perfection longer than when grown on other roots.

The sour Orange as a stock for other citrous trees is a contestant with the longer grown sweet Orange, and as it is free from gum disease, commonly called "foot-rot," and yields abundant crops, it is planted on soils which naturally suit it; these are low, rich lands of both pine and hammock. In the central part of Florida it has run wild, and grows in the open hammock woods where some years ago the best thickets were budded or grafted to the sweet Orange, and up to 1895 bore enormous crops of fruit. The sour Orange does not do so well on higher land, though sometimes planted there, and will not grow at all in dry, coarse sand, where the "rough lemon" manages to exist and produce fruit.

This "rough lemon" seems to be a natural hybrid citrus, with leaves and flowers somewhat resembling the commercial lemon and with large, round, coarse

1558. Sprout-grown Orange tree.

fruit with a lemon's acidity, but with the appearance of a coarse sour Orange.

For quickness of growth and prolific fruiting, no citrous tree compares with the "rough lemon" as a stock for Oranges, lemons, etc., and growers are more successful with it than with any other stock on diverse soils so far tried.

A California orange orchard

Another prominent stock for citrous trees is the wild hardy *Citrus trifoliata* of Japan. It is a very thorny deciduous tree of somewhat dwarf habit, succeeding well on good Orange land not too dry. It influences the cion growing upon it to a great extent and causes a considerable increase of hardiness against cold, as well as earlier ripening of fruit; the tree itself blooms very late in the spring and ripens its fruit comparatively early. In north Florida and along the Gulf coast it is now being largely planted, worked to all varieties of Orange, pomelo, kumquat, etc., with more or less likelihood of successful fruition. It will probably never be wanted as a stock in localities free from frosts. The Orange tree is also worked to a small extent on the roots of other citrous trees, as pomelo, lime, bitter-sweet Orange, etc., with more or less success, as the nature of the land determines.

Propagation of these various trees is usually effected by seed. For sweet seedlings intended for orchard planting, the seed is carefully selected from the fruit of very best qualities, and only the vigorous plants are saved; for the nursery, to be worked by budding or grafting to various sorts, the seed is taken from any fruit available, whether good in quality or not. The seeds are squeezed out of the fruit by hand, after cutting the skin, and not allowed to dry. The seed of *Citrus trifoliata* may be dried, as it keeps longer without loss of vitality.

Seed-beds are prepared by thoroughly digging and pulverizing the soil, which should be of a light or sandy nature, and, unless of very good quality naturally, should be manured slightly with composted stable manure or chemical fertilizer. Seed should be sown thickly on the loose soil and pressed down well before covering; soil of the same light nature should now be thrown evenly over the surface to a depth of about an inch, and if the bed is considerably exposed to the sun should be mulched lightly with straw or leaves. Planters usually provide a temporary shading for the beds or else select a situation shaded by trees or walls, although the seedlings will grow in full sunshine if only mulched, but require more attention in watering. After two to six weeks, according to the warmth of the weather, the seedlings will appear above the surface and must be kept as free as possible from weeds, insects and fungous diseases. "Damping off" causes much trouble, and whole beds may be lost unless sprayed in time to check the spread of this fungous trouble. Bordeaux mixture seems to be the best preparation to use, although thorough dusting with flowers of sulfur sometimes is effectual.

The seedlings at the age of six months, or say during the summer rainy season, may be planted in nursery rows, about 10 x 48 in. apart. Less risk of loss, however, results when transplanting is done in midwinter with one-year-old plants, which at this age should be 6–18 in. high, according to variety. Watering is necessary both at time of setting and occasionally afterward, unless rains are frequent enough to keep the ground well moistened.

Fertilizer is used on poor soil about three times per year in the nursery, and clean tillage is a necessity to produce healthy trees quickly. At the age of three or four years the seedlings are usually budded to the desired varieties just before the growth ceases in the autumn. In spring the tops are cut off a few inches above the live buds, which quickly push out and grow strongly the first few months. Care is now essential in keeping down sprouts from the stock and in training the young bud. Most growers drive a small stake at each stem and tie the shoot thereto with soft twine, topping it to induce branching at the desired height. After a full season's growth the young budded trees will be well hardened and available for planting out in the permanent orchard during the winter months.

Grafting the Orange, as well as all citrous trees, is not so certain a process as budding, the hardness of the wood and heat of a warm climate being against success. Bark-grafting, or sprig-budding, is practiced on old stumps fairly successfully, but other forms of grafting usually fail.

In starting an orchard, the character of soil and drainage must determine the kind of stock to be used. The distance apart for standard trees should be ample, 25–30 ft. seeming about right. Trifoliata stock may be set closer. The land must be staked off and holes thoroughly prepared some time before setting trees. If land is newly cleared and somewhat acid, the soil thrown out of the holes may be sweetened by a liberal mixture of fresh lime, and will be benefited if allowed to remain exposed to sun and air for two or three

1559. Mandarin, a Kid-glove Orange.

months, after which it may be thrown back and the surface fertilized (if necessary) a week or more before setting trees.

The young trees ought to be judiciously pruned at the top to counterbalance loss of roots in digging, and part or all of the leaves may be removed if transplanting takes place in cool weather; the removal of leaves is additional security against loss, less water being needed to establish the roots. In summer, however, the hot sunshine makes it advisable to leave on some foliage to avoid burning or scalding. Winter transplanting is preferable in almost every case.

After transplanting, the trees will be greatly benefited by a mulching of straw, leaves, or trash, which will keep the ground cooler and moister, and in rotting add humus to the soil. Fertilizer during the first years may not be needed if the natural soil is rich, but by the time fruiting commences some elements will probably be needed. If the grower is undecided as to what his soil lacks, a series of soil analyses may be useful in giving a suggestion. Potash, phosphoric acid and nitrogen are the main elements in manures, and the formulæ used in mixing chemical fertilizers may be readily varied to suit each particular orchard. The fertilizer may be purchased ready mixed, or the grower by care and study can make his own mixtures, buying the various ingredients to best advantage. Sulfate of potash, bone-black, and sulfate of ammonia are safe and favorite chemicals for all citrous trees. Fertilizing is usually done in December and again in May or June; sometimes a third application may be necessary in early autumn to properly fill out the fruit.

Cultivation has been for some years along the same lines: light plowing about the time of the winter fertilizing followed by thorough harrowing all through the spring and early summer, keeping weeds and grass well under, and conserving the moisture through the spring drought. After the rains settle down in earnest, all cultivation is suspended and the orchard is sown to various soil-enriching forage-plants, or allowed to develop crab-grass. The abundant foliage of the forage-plants keeps the ground cooler and renders the tree less liable to scald during extremes of heat and moisture; the forage may be cut and cured for hay, but when so doing a return of such loss ought to be made to the orchard, to some extent, from the barn lots, or in applications of mulching or leaf-mold. At all events the orchard should be mowed previous to the time of fruit-gathering.

Since the destructive freezes of 1894–95 and the following three cold winters, growers in the upper portion of Florida have used various forms of protection against frost, for Orange trees. The most general work along

this line has been the banking of tree-trunks with soil up to a height of 1–4 ft., which in the event of freezing carries the budded stem safely through the winter and saves considerable growth. This is only a makeshift, however, to preserve the budded variety and does not protect the top or bearing part of the tree, so that many forms of tents for covering the whole tree have been devised, with heating apparatus. Sheds have also been made with tight walls, covering large areas of trees and having either slatted or movable roofs: during severe cold, open fires, aided by the high walls, keep the temperature above the freezing point. There is also the possibility of warming the air by means of sprays of water, forced from set nozzles by a steam pump, as the temperature of well water in Florida is constantly about 75° Fahr. or warmer. Under sheds trees may be set closer and kept at the very highest state of growth, removing crowded trees from time to time as it may be expedient.

The gathering of the Orange crop may proceed somewhat at the will of the owner; picking, of course, proceeds with the ripening of the different varieties, the early sorts being fit to gather in October, weeks or months before medium and late ripening sorts: all varieties will keep in perfection for several weeks while hanging on the trees.

The fruit from all citrous trees should be cut off, and never pulled, as a rough treatment would cause early decay. Packing is carried on quite uniformly in a great degree of perfection through all the Orange sections of the country; the main essentials to success are a slight wilting of the fruit (two or three days), and a firm, but not extreme degree of pressure, in each package. E. N. REASONER.

ORANGE CULTURE IN THE MISSISSIPPI DELTA.—From the early settlement of Louisiana to the present day Orange culture has received attention in the lower Mississippi valley. Until recently the seeds of sweet Oranges were planted and the young trees transplanted in and around the yards and gardens. No extensive groves were grown until after the close of the civil war. At first groves of seedling trees only were planted and these proved exceedingly profitable up to the very cold spell of 1895, which destroyed nearly every one in the state. In the meanwhile extensive experiments had been made in budding the choice varieties of sweet Oranges on various kinds of stocks, and many of the experiments demonstrated the power of resisting the cold by certain kinds of stocks, notably the *Citrus trifoliata*. Accordingly many of the old groves and a number of new ones

1560. The banking of Orange trees on the Mississippi delta.

were planted in budded stocks, using the buds of selected trees of sweet Oranges and establishing them upon the *Citrus trifoliata*.

Budded stock has thus entirely superseded sweet seedlings. The sour Orange, the bitter-sweet Orange, the rough lemons, the grape-fruit or pomelo and the *Citrus trifoliata* have all been used successfully as stock for the sweet Orange. In the meanwhile several hardy Japanese varieties, including the Satsuma, Mandarins and Tangerines, were introduced and budded upon various kinds of stock. In 1895, with the temperature going down to 15° F. in New Orleans, it was found that the combination of the hardy Japanese varieties upon the *Citrus trifoliata* alone withstood the cold. This experience caused an adoption of the *Citrus trifoliata* as the chief stock for future groves. Accordingly nearly all of the groves planted since that time have been with this stock.

But there is a frost limit beyond which this combination is destroyed. This was evidenced by the unprecedented freeze of February, 1899, which again destroyed nearly every grove in the state. Since that time Orange planting has made very slow progress, and only a few large groves are to-day to be found in the state. The industry is, however, so profitable that a renaissance may be expected at an early day. The budded trees bear early and yield profitable returns in three to five years after being transplanted in the grove. The city of New Orleans furnishes a home market for all that can be raised, and the Louisiana Orange is about one month ahead of those of Florida and several months ahead of California in ripening, and, therefore, reaches the market when, on account of scarcity, good prices prevail. These facts, coupled with the readily productive soil, requiring no fertilizers, and the abundant rainfall, dispensing with irrigation, make Orange culture exceedingly profitable in Louisiana, and the only drawback is an occasional blizzard from the northwest, which drives gulf-ward the usually balmy climate and temporarily chills the groves. At rare intervals these blizzards are so intense as to destroy tree and fruit.

How to protect groves against these destructive frosts is to-day the "burning question" with the Orange growers. Flooding the orchard with water from the river upon the approach of a freeze has been practiced upon a large scale without complete success.

The practice of banking the tree—piling the soil around the stem to a height of a few feet (Fig. 1560)—on the approach of a blizzard whose intensity and time of coming are usually predicted by the government weather bureau, is now almost universally adopted as the best protection against excessive cold. This banking retains vitality in the main trunk, and while the outer limbs are killed young shoots will start from the tree when the soil is removed and spring advances. This practice gives only partial protection. The tree is virtually destroyed, but new shoots from the protected trunk will soon appear and in a year or two the tree has resumed shape and is ready to bear a crop. The crop for the ensuing year or years is destroyed, but by skilful care the grower is enabled to secure a renewed plantation quickly.

The sweet, the sour, the Mandarin (Fig. 1559), Tangerine and Satsuma, the Shaddock, the grape-fruit, the Kumquat and the trifoliata, are all grown quite largely in Louisiana. The Myrtle and the Otaheite are occasionally found as ornamental trees.

The Orange is grown in this state directly from seed and from buds. Budding is done at any time of the year from early spring to late fall. When performed in the fall, the buds remain dormant through the winter. The various stocks have particular merits for special soils and other conditions, and several kinds are used, as already said; but when the chief obstacle to successful Orange culture is cold, all other considerations must be dispensed with and only the most resistant stocks used. These are, first, *Citrus trifoliata*, and, second, sour Orange. Hence nearly all the Louisiana groves are on these two stocks, a large majority being on the former.

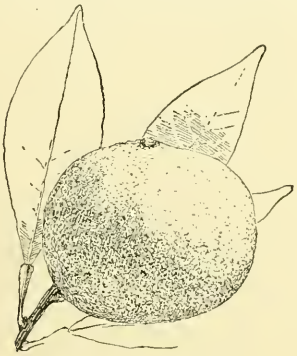
Planting a grove is always preceded by a nursery. The latter is made by planting the seed of the *Citrus trifoliata* or sour Orange. When the young trees are one to two years old they are shield-budded with buds from selected varieties. One year after, these buds are large enough to be transplanted to the grove.

The soil of the grove is thoroughly prepared and pulverized, and well drained. The trees are planted at intervals of 20 to 40 feet apart both ways, and the grove is cultivated until the trees are large enough to shade the ground. After that only the weeds and bushes are kept

Plate XXIII. Citrous fruits (about one-half natural size)
ORANGES, Nonpareil and Parson Brown; MANDARIN, Cleopatra; KUMQUAT, Nagami; POMELO, Royal

down. Late and early cultivation of an Orange grove is usually discouraged as having a tendency to induce a too luxuriant, sappy growth, which may be injured by subsequent frosts. The cultivation is usually performed with light plows or suitable cultivators.

In three years after a grove is planted the trees should begin to bear, increasing its products every year



1561. Satsuma Orange (×⅛).

thereafter and becoming exceedingly profitable at 5 to 6 years. It has been found best here to head the Orange tree low, and prune it only for shape and comfort. Excessive pruning is never followed.

When ripe, the Oranges are gathered by hand from ladders, assorted and packed in boxes or barrels and shipped to New Orleans. Before the late excessive cold the crop of the state was estimated at 500,000 boxes. It was quite small last year, as the result of this freeze.

A fertilizer containing 50 pounds nitrogen, 50 pounds potash, and 25 pounds phosphoric acid per acre is the one usually recommended in this state. It is usually applied in March or April. The following varieties have been grown in this state, which, for convenience, are here divided into three classes: first, early ripening; second, medium; third, late.

Of the first class there are numerous creole strains,—Beach Nos. 1 and 2, Boone Early, Brazilian, Centennial, Early Oblong, Foster, Homosassa, Nonpareil, Parson Brown, Peerless, Pride of Malta, and Whitaker, of the sweet varieties; and the Satsuma (Fig. 1561) and Mandarin, of the dulcis type. In the second class are Acapulco, Baldwin Nos. 1, 2 and 4; Beach No. 3, Bessie, varieties of Blood Orange, Circassian, Cunningham, Dulcissima, Exquisite, Jaffa, Joppa, Magnum Bonum, Majorca, Madame's Vinous, varieties of Navel Orange, Old Vini, St. Michael, Portugal, Prata, Queen, Ruby, Selecta, Star Calyx, Stark Seedless, Sweet Seville, Tahiti and Traveler, of the sweet Orange, and Tangerine, of the dulcis type. The third class—late maturing varieties—which are unpopular here on account of danger of frost during winter, are Acis, Beach Nos. 4 and 5, Dorr, DuRoi, Higley Late, Lamb Summer, Long, Maltese Oval, Mediterranean Sweet, Mott, Pineapple, Rio, Rivers Late, Simms Summer, Hart Tardif, and White, of the sweet, and King, of the dulcis type.

The Kumquat is grown both in the round and the oblong. A dozen or more varieties of the pomelo are also grown, while a few varieties of the sour Orange and shaddock are occasionally to be found. W. C. Stubbs.

Oranges in California (Fig. 1562).—In 1769 the Franciscans moved northward into what is now known as California. In connection with the Missions which they established they planted gardens and orchards, and the first Orange trees planted were from seeds, cuttings, or plants introduced by these worthy and thrifty padres.

The Missions were scattered over a wide range of country, as far up as Sonoma, some fifty miles north of San Francisco. The planting and care of orchards of both citrous and deciduous fruits was encouraged, but after the secularization of the Missions, in 1834, interest waned and they were neglected, so that in 1846 Fremont wrote of them that "little remains of the orchards that were kept in high cultivation at the Missions. * * * Fertile valleys are overgrown with wild mustard; vineyards and olive orchards are decayed and neglected."

At the Mission San Gabriel, in what is now Los Angeles county, were the most extensive orchards; and it was 86 years afterwards that the seed of an Acapulco Orange was planted at Sacramento, and four years later transplanted to Bidwell's Bar in Butte county, in the northern part of the state, and more than five hundred miles from the locality selected by the Mission Fathers for their first plantings.

While the climate of California, from San Diego in the south to Shasta in the north, is more or less suited to the Orange, and there are localities especially well adapted to its culture, there are some regions in the coast range as well as in the Sierra Nevada mountains where the low winter temperature prohibits its growth. The question of soil also enters largely into this problem, and considerable special knowledge is required in order to make a judicious selection.

The southern portion of the state was first selected as most promising, but since about 1890 every year has shown a vast widening-out and extension of the Orange belt. The business did not assume any commercial importance till 1880, when, and for some years afterwards, Orange groves were planted with feverish haste, consequent upon the enormous prices obtained for the product. As a natural outcome thousands of inferior trees were set out, unsuitable varieties in unsuitable localities, and seedlings which were of little value. The nurserymen could not grow stock fast enough, and the stock was often bought a year in advance. In a few years, however,

1562. A California Orange grove.

Orange culture became better understood, until in 1899 the returns made by the county assessors showed an acreage in Orange trees alone, not including lemons, of 35,000, or 3,500,000 trees, nearly half of which were in bearing.

The foot-hill region of the Sierras was soon found to be capable of producing fine Oranges, notably in Placer county; later on in Kern, Tulare, and Fresno counties, and in the whole of the Sacramento and San Joaquin valleys were found large areas where Oranges could be grown as fine as those in southern California, and in some instances they were found to ripen earlier.

In some places, notably about Oroville in Butte county, near the extreme northern part of the Sacramento valley, the citrous industry thrives, side by side with gold-mining. The red, mineral lands, with abundance of water carried in ditches from the high mountains, grow to perfection the Washington Navel and other Oranges.

Though the temperature of the great San Joaquin valley is lower in winter than at points nearer the coast, the summers are warmer, and the Orange thrives in the sunshine, away from the coast fog, and the trees are healthier and less affected by scale insects.

The so-called "thermal belt" comprises some 1,500,000 acres of land adapted to the cultivation of the Orange commercially, and in every part of California, with exceptions above noted, Oranges may be grown in a small way, to satisfy the taste and embellish the home surroundings. This "belt" runs from San Diego to Tehama, and is nearly 700 miles long, and from two or three to twenty-five miles wide. Its altitude does not exceed 1,800 feet above sea-level, and from that down to 30 feet.

Orange seedlings were grown mostly from seed of imported Tahiti Oranges, and later from miscellaneous seed from any varieties. Seed from the Florida Sour stock has been largely used, but does not give general satisfaction. The young plants are budded in the nursery at two years old, and transplanted one or two years later to the orchard. Very many large, old trees have been "worked over," because the variety was found to be unprofitable. There are several ways of doing this, perhaps the most successful being to cut back the top of the tree, and to bud into the young shoots that will grow as a result of this cutting. In three years the old tree will have a new top, frequently with a good crop of fruit.

The Orange is a gross feeder, throwing out many and widely spreading roots, and for this reason, though the soil may be naturally rich, it is necessary that it be plentifully supplied with fertilizers as well as water. This is done systematically and regularly, the trees being irrigated not less than once a month through the summer by means of shallow furrows opened by the plow on either side of the row.

The varieties considered most valuable for market are Washington Navel, Paper-rind, St. Michael, Malta Blood, Jaffa, Mediterranean Sweet, Parson Brown, Homosassa, and some of the Tangerine varieties. Of all these the Washington Navel is by far the most valuable. The first trees were imported from Brazil by William Saunders, of Washington, D. C., in 1870, and by him sent from there to California in 1873. The fruit is seedless, which adds to its value. Oranges are cut from the tree with small shears in preference to being pulled. After they have been kept in the packing-house for a few days to allow the rind to shrink, they are graded and packed in the regulation case, which is 11½ x 11½ x 26 inches. This work is done with the utmost care, and by experienced, skilled hands.

The output of Oranges from California, for the last two seasons (1897–8 and 1898–9), has reached the enormous amount for each season of 14,000 car loads, or 4,000,000 boxes, representing a value of about $6,000,000, f. o. b. California.

LEONARD COATES.

ORANGE, OSAGE. See *Toxylon.*

ORANGE ROOT. Same as Golden Seal, *Hydrastis Canadensis.*

ORCHARD. In America the word Orchard is used for any laid-out plantation of fruit trees. It is not applied to bush-fruit plantations, as it is sometimes in England. The Orchard is a part of every typical American homestead, although it may be of very small extent. The universal Orchard, except in the warmest parts, is the apple Orchard; pears and plums are probably next in domestic importance. Consult *Pomology.*

ORCHARD GRASS. *Dactylis glomerata.*

ORCHARD HOUSE, a name frequently used in England for glasshouses devoted to fruit trees. Consult the article on Forcing of Fruits, p. 598 (Vol. II.) of this work.

ORCHID. The Orchids are perennial herbs distinguished from other monocotyledons by the union of the stamens and pistils with the floral axis, forming a unilateral column. With the exception of the Cypripedineæ only 1 anther and 2 stigmas are fertile; in the Cypripedineæ 2 anthers and all 3 stigmas are fertile. The nearest relatives of the Orchids are the Scitaminaceæ. The Orchids form a vast group of plants (about 10,000 species) which, on account of the unusual transformation of their flowers, their strange shapes and glowing colors, and their varied adaptations for securing cross-pollination, are amongst the most fascinating of all families of plants.

PART I. POPULAR ACCOUNT OF ORCHIDS.

The peculiar interest which attaches to Orchids is due, in a great measure, to the endless variation of the flowers. Few Orchids not in flower are remarkable for their beauty. The barren canes of Dendrobium or the shriveled leafless pseudobulbs of Pleione are curious but scarcely beautiful. In many groups the color of the flower is of secondary importance. Many of the highly prized Cypripediums have only modest colors, while some cacti have brilliantly colored and lasting flowers, yet these have not become general favorites.

The great variety of the Orchid flower is produced, not by the creation of new organs, but, as everywhere else in nature, by the modification of parts already existing. The general plan of the Orchid blossom is like that of most of the flowering monocotyledons, as, for example, the lily.

The Sepals.—Of all the floral organs the sepals are usually least modified. They can be easily recognized. In some cases, however, they are sufficiently modified to change the appearance of the flower. Often the lower pair are more or less or entirely united (Oncidium, Cypripedium). In Masdevallia all the sepals are united into a short tube and then expand into blades terminating in long curious tails.

The Petals.—Of the second whorl of floral organs two only are generally petal-like, the third being transformed into the labellum. The two similar petals usually resemble the dorsal sepal. This resemblance is often carried out to a striking degree, which is most remarkable in cases in which these organs are unusually modified (*Oncidium Papilio*). Some peculiar modifications of the petals exist. In *Selenipedium caudatum* (Fig. 1563) they are elongated to an almost ludicrous extent, often attaining a length of three feet. In this species peloric flowers occur in which the third petal or lip is also petal-like (*Uropedium Lindeni*). In many other instances the petals differ greatly in size and form from the sepals (Bullophyllum, Masdevallia).

The Labellum.—The form or type of the flower depends greatly on the character of the labellum. This is the most wonderful and most modified of all the floral organs. It is often the most conspicuous part of the flower and is of the greatest importance to the plants, as Darwin has shown, in attracting insects and guiding them to the nectar, and hence to the pollen and stigmas of the plants. In Cypripedium and related genera the lip has the form of a sac often compared to a shoe, as the name Lady's Slipper indicates. The sides of the sac are folded inward, surrounding the column in such a way that an insect which has entered the labellum must crawl out through a narrow opening near the anther, which is thus brushed. Some of the pollen adhering to the body of the insect is thus carried to the stigma of another flower.

One of the most common forms which the labellum assumes is that of a trumpet-like tube inclosing the column. The front portion is expanded into a large, variously-shaped blade, which is often of a deeper color than the rest of the flower. The color becomes more intense toward the tube or throat of the labellum, which is further ornamented by ridges, crests, and markings, all of which serve to guide insects to the pollen masses

Phalænopsis amabilis

Schomburgkia undulata

Cymbidium eburneum

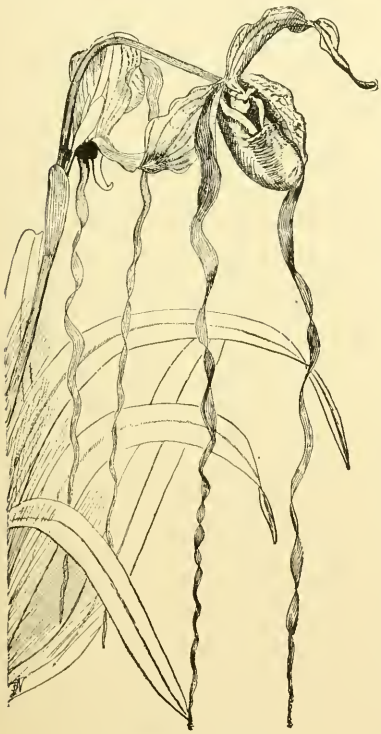
Dendrobium thyrsiflorum

Cattleya Schrœderiana

Oncidium Krameriauum

Some genera of Orchids

and stigmas. The trumpet form of the lip is characteristic of many of the most beautiful South American Orchids, as Sobralia, Lælia, Cattleya, etc. In other genera the labellum is variously modified. Sometimes it is small and petal-like, sometimes greatly expanded, forming the most conspicuous part of the flower (*Oncidium tigrinum*, *Odontoglossum Londesboroughianum*).



1563. Selenipedium caudatum.

In other instances it is almost indescribably transformed (Stanhopea, Gongora).

In nearly all cases the labellum is provided with raised lines, crests, and markings for guiding the insects. In many genera the base is produced into a sac or spur, which secretes honey, or whose walls contain juices which are sought by insects. In the curious Madagascar Orchid, *Angræcum sesquipedale*, the spur attains the astonishing length of 10 or 11 inches (Fig. 1564).

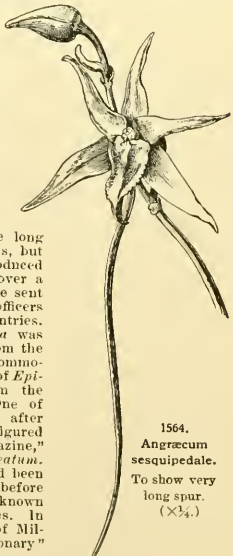
The habit of Orchid plants is almost as varied as that of the flowers themselves. It is dependent upon the mode of life of the plants, which, in this respect, may be divided into three classes.—saprophytes, epiphytes, and terrestrial Orchids. True parasites are not known to occur in this family.

The saprophytic Orchids are the most reduced forms, devoid of chlorophyll, and depending for their carbon food upon the organic matter of the humus in which they grow. The subterranean stem or rhizome consists of a much-knotted coral-like mass which takes the place of roots. In most species the rhizome has been found to be invested with a fungus by means of which organic matter of the humus is absorbed and transformed into compounds available to the plant. The annual shoot is a brownish or yellowish stem bearing a few scales and a simple terminal inflorescence. Few, if any, of these plants are successfully cultivated, as it seems impossible to reproduce all the natural conditions. Common examples are the North American Corallorhizas.

The epiphytic Orchids exhibit the most varied forms. These inhabit branches of trees, dead trunks, and often barren rocks in exposed places. They grow, without exception, in tropical or subtropical countries where a part of the year is unfavorable to growth. As a result of this, they have developed special food reservoirs, pseudobulbs, terminating each season's growth. In this group there are comparatively few plants of attractive habit. They are generally devoid of graceful foliage, each pseudobulb bearing a few stiff, leathery leaves. The older pseudobulbs become shriveled and leafless, detracting from the appearance of the plants, and in Pleione the plants are entirely leafless at the flowering time. In some of these, however, the pseudobulbs are numerous and closely crowded, and retain their foliage, making plants of neat, compact habit (Cœlogyne, Miltonia).

The terrestrial species include some of the largest and most stately Orchids of the tropics as well as most of the Orchids of the temperate zone (Habenaria, Orchis, etc.). Many of these are ornamental even when not in flower. The species of Sobralia are noted for their tall, reed-like stems well clothed with graceful foliage. In the tropics they often form dense thickets from 6–12 ft. in height. Most of the species of Selenipedium also have luxuriant foliage, which is attractive at all times.

Foliage Plants.—The Physureæ, a small group of Orchids distributed in tropical Asia and the Malay Islands, with a few species in Africa and North America, are remarkable for their beautifully variegated leaves (Physurus, Anœctochilus). The plants themselves are usually small, with the habit of Goodyera, a North American representative of the group. Variegated or mottled leaves occur also in some other groups (Cypripedium, Phalænopsis, and Oncidium).

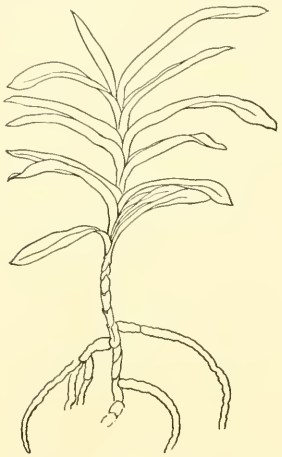


1564. Angræcum sesquipedale. To show very long spur. (×¾.)

Historical Sketch.—Species of Orchids have long been known to botanists, but the first plants were introduced into hothouses scarcely over a century ago. Plants were sent by missionaries and officers who visited tropical countries. In 1731, *Bletia verecunda* was received in England from the West Indies. In 1789, Commodore Gardner sent plants of *Epidendrum fragrans* from the woods of Jamaica. One of these flowered two years after and was the first Orchid figured in the "Botanical Magazine," plate 152, as *E. cochleatum*. *Phaius grandifolius* had been introduced nine years before and the Vanilla was also known in English conservatories. In 1807 Martyn's edition of Miller's "Gardeners' Dictionary" enumerated 124 Orchids.

At first the wants of these plants were little understood, and many perished from irrational treatment. But as more species were introduced and their natural climatic conditions became better known the plants were treated in accordance with their requirements.

The middle part of this century is remarkable for the great number of new and striking kinds of Orchids discovered. Immense sums were paid for single new plants. The fabulous prices paid for novelties caused collectors to scour every part of the tropics, risking their lives in



1565. Vanda, an example of monopodial growth in Orchids.

the mountains, jungles and fever-haunted swamps in search of these wondrous plants. At the present time collectors are still engaged in searching the tropics, but striking novelties are rarely introduced. Large quantities of Orchids are annually imported to replenish northern hothouses. It is probable that large sums for single plants have been paid more frequently for Orchids than for any other class of plants. A thousand dollars for a unique plant is perhaps paid less frequently nowadays than in the middle of the century. Nevertheless the interest in Orchids is not declining. On the contrary, the love for Orchids is becoming more widespread. There never has been any distinct Orchid craze followed by a severe reaction, as in the case of the tulip, dahlia, zinnia, camellia, etc., but the interest has gradually extended and is likely always to increase steadily.

Cut-Flowers.—The use of Orchids as cut-flowers is slowly becoming more and more general. Many kinds are easily cultivated with general florists' plants and are thus becoming widespread in cultivation (Cypripedium, Cattleya, Lælia). As yet none of the Orchids can be regarded as florists' flowers in the same sense as roses and carnations. Their use is mostly restricted to special purposes, although they are gaining in popularity. Cattleya, Cypripedium and Dendrobium are, perhaps, the only genera listed in the wholesale market during midwinter. The wonderful keeping qualities of Orchids as cut-flowers are well known. An Orchid flower loses its beauty within a few hours after fertilization.

Orchid Hybrids.—One of the most fascinating phases of Orchid culture is the production of hybrids. By crossing of different species and even genera numerous new Orchids have been produced, many of which are superior to the natural species. In some genera the hybrids now far outnumber the original species, notably Læliocattleya.

A large and special literature on Orchids has grown up. Magnificent periodicals, with descriptions and colored plates, have been entirely devoted to Orchids. Notable among these are "Lindenia," Ghent, 1895 and continuing; "Reichenbachia," published by Sander, "The Orchid Album," by R. Warner and B. S. Williams, London, 1882–96; "L'Orchidophile," Paris, 1881–1893, and the "Orchid Review," London, 1893 and continuing, are more popular journals devoted to Orchids. Among the larger monographs are Bateman's "The Orchidaceæ of Mexico and Guatemala," and "A Monograph of Odontoglossum," by the same author. Many plates and descriptions of Orchids occur in the "Botanical Magazine" and in the "Botanical Register." Many of Reichenbach's new species were described in the "Gardener's Chronicle." Among the manuals which have appeared are "A Manual of Orchidaceous Plants Cultivated under Glass in Great Britain," by A. H. Kent, issued in parts by James Veitch and Sons, and "Orchids: Their Culture and Management," by W. Watson. No comprehensive American work has as yet appeared. A list of all known hybrids, however, is given by Geo. Hansen, "The Orchid Hybrids," 1895, including first supplement; second supplement, 1897. This is an American work.

Species in the American Trade.—Orchids are mostly advertised in special catalogues. All the names found in the catalogues of Wm. Mathews (1890), John Saul (1893–6), Pitcher & Manda (1895), and Siebrecht & Wadley are accounted for in this Cyclopedia so far as possible. Some catalogues of European dealers who have American agents—as Sander & Co.—are included. The Mathews collection has fewer species now than in 1890, but it is larger in a general collection of commercial kinds. The collections of Saul and of Pitcher & Manda are dispersed, and many of the rarer and more difficult subjects have doubtless perished. In the nature of the case it is impossible to determine at any given time what species of Orchids are cultivated in America. The great private collections contain many rare kinds imported through foreign dealers. Many species which are known to be cultivated by American amateurs, have been included in this work, although the species are not listed in American catalogues.

Part II. Botanical Account of Orchids.

All Orchids are perennial herbs which increase in one of two ways. The simplest form which the vegetative axis may assume is that of a monopodial stem which increases by the continual growth of the terminal bud. Monopodial stems occur in Angræcum, Vanda (Fig. 1565), Phalænopsis, etc. Lateral branches may be formed, but they do not interrupt the growth of the main axis, and never exceed it in length. The growth may be interrupted by a period of rest, but this is not manifested on the stem by the formation of scales, etc.

1566. Dendrobium; a sympodial Orchid with lateral flower shoots.

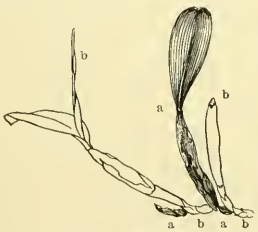
The dark and light parts, *a a* and *b b*, represent each the growth of one shoot.

All the leaves are similar. The inflorescence consists of a separate axillary branch bearing bracts and flowers.

In the greater number of Orchids the terminal bud ceases to grow at the end of the season, either terminating in the inflorescence or blindly. The new growth

is continued by an axillary bud originating in the axil of one of the leaves. The whole plant is thus built up of branches sympodially united. The lower part of each new axis is prostrate at first and bears only scales. It is known as the rhizome. Later the apex turns upward and bears ordinary leaves. In many the erect portion of the stem becomes thickened into a food reservoir known as a pseudobulb. The pseudobulb itself may consist of several internodes, as in Lælia, Cattleya. It is then clothed with leaves, at least when young, and bears the scars of the fallen leaves. In other cases only a single internode is thickened. This bears 1 or 2 lvs. at the summit, but has no leaf-scars. The new shoot which continues the growth of the plant arises in the axil of one of the scales below the pseudobulb. The manner of growth is shown in Figs. 1566 and 1567, in which the parts marked *a a* and *b b*, respectively represent the growth of a branch with its basal portion or rhizome and the terminal portion or pseudobulb. In the terrestrial Orchids pseudobulbs are usually not formed and the erect portion is a long or short stem clothed with leaves (Sobralia, Selenipedium). The inflorescence is either axillary (Dendrobium, Fig. 1566) or terminal (Cattleya, Fig. 1567).

The habit of the plants depends in a great measure upon the rhizome. When this is long the plants are loose and straggling, and when it is short they are compact in habit. In some the rhizome becomes suberect or climbing (species of Lycaste).



1567. Cattleya.
The light and shaded parts, *a a* and *b b*, each represent one year's growth.

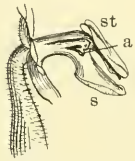
The Orchid flower exhibits perhaps the greatest specialization and adaptation found anywhere in the vegetable kingdom. The 2 outer whorls of floral organs, the sepals and petals, have been sufficiently described.

In the monocotyledons there are normally present 2 whorls of stamens. In the Orchids only 1 or 2 of these are fertile. In the Monandræ (Cypripedium, etc.) the odd stamen of the outer whorl is developed into a wing-like staminodium (Figs. 1568, 1569, *st*). The similar stamens of the inner whorl are fertile, and form 2 anthers, 1 on each side of the staminodium (Figs. 1568, 1569, *a*). In all the other Orchids, except in abnormal cases, only the odd stamen of the outer whorl is fertile, bearing an anther situated at the top of the column (Fig. 1570, *a*). The similar two of the inner whorl are developed as staminodia, forming the sides of the clinandrum or anther-bed. Often they are developed into crests or ears on the column. Traces of the other stamens are rarely found in the flower. Compare Figs. 642–644, Vol. I.

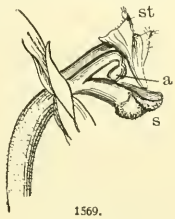
The 3 pistils are developed in Cypripedium and a few related genera. In these the stigma is clearly 3-lobed, showing the union of 3 pistils (Figs. 1568, 1569, *s*). In most of the other genera only 2 of the stigmas are receptive, the third being developed into the curious rostellum. In some cases the stigmatic surfaces are confluent into one, while in others they remain more or less distinct. Generally they appear as flat surfaces often sunken in a depression in the column (Læliineæ, Fig. 1570, *s*, and many others). In a few cases the stigmas are more or less elevated on stalks (Habenaria). In Sophronitis they extend partially along two wing-like projections of the column.

The odd pistil, the rostellum, is situated above the

stigmas, separating them from the anther-bed. In the Læliineæ its lower surface is still continuous with the stigmatic surface (Figs. 1570, A, B, *r*). The principal function of the rostellum is the secretion of a viscid fluid, by means of which the pollen masses adhere to insects visiting the flowers.



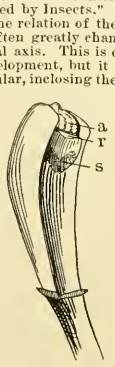
1568. Cypripedium.
st, staminodium; *a*, auther; *s*, stigma.



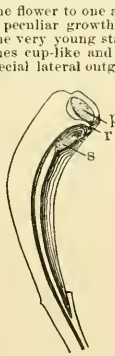
1569. Selenipedium caudatum.
st, staminodium; *a*, anther; *s*, 3-lobed stigma.

The anther lies above the rostellum, within a depression or anther-bed (Fig. 1570, *a*). Its cells vary from 2–4 or 8. In nearly all the Orchids the pollen coheres in masses or pollinia (Fig. 1570, *p*), the number of pollen masses corresponding to the number of anther cells. Often the viscid substance uniting the pollen grains is prolonged into a stalk (caudicle), which extends beyond the anther and comes into contact with the viscid substance secreted by the rostellum, which forms an adhesive disk by means of which the pollinia become attached to insects. In many Orchids the outer layer of the rostellum itself separates by a dissolution of the underlying cells, and thus forms a stalk (stipe), which becomes attached to the pollinia by means of the product of the dissolved cells. Whatever its origin, the stalk, with its viscid disk, forms one of the most important parts of the mechanism by means of which pollen is transported from flower to flower, insuring cross-pollination of the group. The details of the mechanism by which this is accomplished have been beautifully explained by Darwin in his classical work, "The Various Contrivances by which Orchids are Fertilized by Insects."

The relation of the parts of the flower to one another is often greatly changed by the peculiar growth of the floral axis. This is convex in the very young stages of development, but it soon becomes cup-like and finally tubular, inclosing the ovary. Special lateral outgrowths



A.
Column of Cattleya.
a, anther; *r*, rostellum; *s*, stigma



B. Section through the column of Cattleya.
p, pollinium; *r*, rostellum; *s*, stigma

1570. Details of the column of Cattleya.

near the top of the ovary form the "foot" of the column found in many orchids (Pescatoria, Phaius). When the foot is present the labellum is attached to its apex, and often the sepals are decurrent upon it, forming a men-

tum. In nearly all Orchids the stigmas and anther are carried up by an elongation of the floral axis, to which in this instance the name "column" is applied. In Gongora the petals and dorsal sepal are carried far away from their normal position.

The fruit of Orchids is a dry capsule requiring a long time to ripen, so that if an Orchid is fertilized during one rainy season its seeds are not disseminated until the next wet season. Very few fleshy fruits occur in this family. The seeds are minute and extremely numerous, thus compensating, perhaps, for the uncertainty of fertilization.

The Orchids are distributed over the entire world. They are most numerous in the tropics, becoming rare in the cold zones. They are chiefly collected in three regions, the South American region embraciug Mexico, South America and the neighboring islands. Most of the large genera are fonnd in this region (Epidendrum, Pleurothallis, Oncidium, Odontoglossnm, etc.). The second region, embracing India and the Malay Islands to Australia, is rich in genera, but most of them are small, containing far less than one hundred species. The largest genus of this region is Dendrobium, with 300 species. The South African region contains few terrestrial Orchids, of which Disa is the only one of importance in cultivation. HEINRICH HASSELBRING.

PART III. THE CULTURE OF ORCHIDS.

Introductory.—Duriug the early days of Orchid culture the treatment of the plants under glass was imperfectly understood, and with the meager knowledge of the natural conditions surrounding them in their native habitats, little successful progress was made for many years. The few cultural directions to be found were in works of foreign publication, scarcely applicable to plants grown in our houses in America, where the winters are severe and changeable and the heat of our summers more intense and less humid, necessitating a different mode of treatment. With a more satisfactory understandiug of their requirements during the last 25 or 30 years, Orchid culture here has made a rapid advance and most of our best collections have come into existence, many of which offer a very favorable comparison in fine, well-grown specimens with those of the Old World.

Orchid Houses and Their Construction.—Various are the opinions of cultivators regarding the proper construction of Orchid houses to obtain the best results. Twenty-five or more years ago many fine specimens of Orchids were grown without a special house, along with general stove and greenhouse plants, and we still find many good plants cultivated in this manner, but where a general collection of Orchids is grown four separate houses or divisions will be found necessary to obtain the best results. These are known as the "East Indian," "Brazilian," "Mexican" and "New Granadan," or Odontoglossum departments.

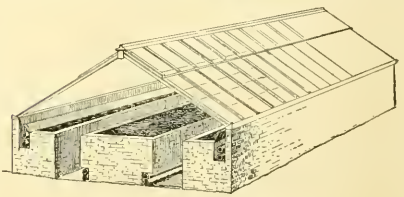
The East Indian department requires a winter temperature of 65° to 70° F. by night and 70° to 75° F. by day; a few degrees' rise with sun heat will do no harm. The temperature should be gradually increased 10 degrees toward midsummer and gradually decreased toward late fall. This is the warmest house and is used for the cultivation of Aërides, Angræcums, the warmer tropical Cypripediums, Phalænopsis, Calanthes, Dendrobiums and Thunias while growing.

The Brazilian department should range during winter from 60° to 65° F. at night and about 70° F. during the day, allowing a few degrees more with solar heat, and a rise of 10 degrees toward midsummer. This department is for Bulbophyllnms, Cattleyas, warm Epidendrums, Brazilian Lælias, Miltonias of the cuneata and spectabilis sections, *Odontoglossum citrosmum*, Stanhopeas, and various genera and species requiring a like temperature.

The Mexican department is used chiefly for the cultivation of *Cœlogyne cristata*, Mexican Lælias, growing Lycastes, Anguloas and Acinetas, many species of Maxillaria, a majority of the Oncidiums and warm Odontoglossums, Phaius and allied species which require a few degrees lower night temperature and usually a little more sunlight to ripen their tissne for flowering than is afforded in the Brazilian department. It is also invaluable for resting Dendrobiums and many other deciduous and terrestrial Orchids.

The New Granadan or Odontoglossum department must be kept as cool as possible in summer, and during winter should range from 55° to 60° by night and 60° to 65° F. by day, and as cool as possible during summer; it is used principally for Masdevallias, Odontoglossums, more especially *O. crispum*, and allied genera, Disas, cool Oncidiums, such as *O. ornithorhynchum* and *O. variccsum*, Lycastes in warm weather, and many other individual species from high altitudes which require a cool house at all seasons or they suffer from the heat of our summer.

The fundamental principle in building an Orchid house is to get a structure that can be easily heated and which has a naturally moist atmosphere, without excavating deeply, for houses built much below ground lack circulation and almost always prove detrimental to Orchid culture. The houses (excepting the New Granadan house) should be built to run north and south with an east and west exposure, in order that they may receive the benefit of the early morning and late afternoon snn, with the least possible heating effects from it at noonday, thus making little ventilation necessary; atmospheric moisture will be more easily retained in such a structure. The houses may be as long as requred (with the potting-



1571. Section of a small, well-constructed Orchid house heated by hot water.

shed at the north end to avoid unnecessary shade and protect the houses in winter against severe north wind), and about 16 ft. wide, which will allow two side beds of 2½ ft. each, two walks of the same width, and a center pit 6 ft. wide. From floor to ridge should be 10 ft. and to the eaves 4½–5 ft. Top ventilators should extend along both sides at ridge, thus affording protection from direct cold winter drafts in airing by using the sheltered side. Side ventilation is unnecessary and often injurious, the direct drafts causing plants which are out of condition to shrivel.

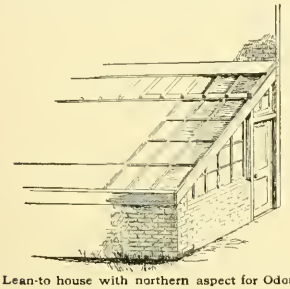
In glazing Orchid houses the glass used should not be less than 12 x 14 in., and larger if possible. It is also important that only the bestquality procurable be used, free from lenses which would burn the leaves when shading is removed. Plate glass is much to be preferred when it can be had, as it contains no lenses and gives a pure even light. If this is used a size about 16 x 24 in. will be found very serviceable. Poor glass should not be used in any case, as it necessitates sha ling long before this is beneficial to the plants.

The ontside walls should be built of brick or stone when possible, and the beds and pits within should be of the same material, 8 in. thick and about 3 ft. in height, filled solid to the top, using stone or rubble for drainage in the bottom, following it up with finer material and finishing with an inch or two of fine gravel. Wooden benches may be used if desired, often with first-class results, by covering them 2 or 3 inches deep with ashes, sand or gravel, but the solid benches are more sure to give better satisfaction. They give off moisture more gradually and offer a cool footing for the plant both winter and summer, which is essential and natural.

Good results will follow from either steam or hot water heating when both are properly conducted, steam necessitating, perhaps, more care. Unless the range of glass is large and a night fireman is kept, the old-fash-

An Orchid fancier's house

ioned method of hot water under natural circulation will be found best, using the regulation 3½-inch pipe, running the flows along the back beneath the eaves and returning along the floors beneath. See Fig. 1571, which

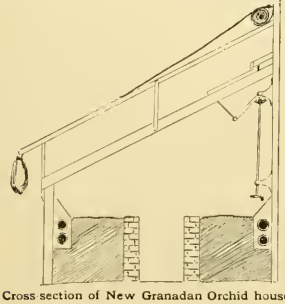


1572. Lean-to house with northern aspect for Odontoglossum crispum and other New Granadan Orchids.

fairly illustrates a properly constructed house. The quantity of pipe required for heating a house depends upon the location and degree of heat desired. A slab or board should be placed along the back of the side beds to throw the heat against the eaves and protect the plants from direct heat before it has assimilated with the moisture of the house.

The New Granadan house should be a lean-to structure of northern aspect, with a wall of stone or brick along the south side to protect it from solar influence as much as possible (see Fig. 1572). The glass should be protected by canvas roller shades raised 15 or 20 inches above the glass on framework. One side of the canvas should be tacked along the top of the house, and the other to a round wooden roller 3 or 4 inches in diameter and as long as convenient to draw up; the two ropes should be fastened to the ridge, carried down beneath the shade around the roller, and up over the top to a single pulley near the ends; thence through a double pulley in the center and down over the top of the shade to the ground. By these ropes the shade can be raised and lowered in cloudy and bright weather at will (see Fig. 1573). Solid beds and piping similar to the other Orchid houses can be used, or as in Fig. 1571; viz., a flow and return down each side connected with valves so that either or both sides may be used as desired.

Shading of some sort on the glass is necessary for all Orchid houses from early February until November,

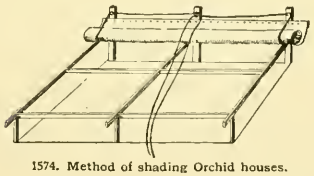


1573. Cross section of New Granadan Orchid house to show solid beds and methods of heating and shading.

and in some cases also during the winter months, to protect the plants from the sun. It may be either of canvas, as in Fig. 1574, or consist of whitewash or paint applied directly to the glass. Whitewash made from fresh lime is perhaps the best to use, as it is easily removed in the fall. The first application in February should be light, following it with a second coat a month later, and, if necessary, a third one in July. This will wear off gradually and in most cases should be entirely removed during December. It is easily removed with a stiff brush. There are also patented shadings.

The Two Great Horticultural Groups.—Orchids are horticulturally divided into two large sections; viz., terrestrial and epiphytal, the former embracing those which grow on the ground and derive their nutriment more or less directly from it; and the latter those which usually attach themselves to rocks and trees, and derive a greater portion of their nutriment from the atmospheric gases and accidental deposit of decaying leaves, or grow among the various ferns and vines, which grow in abundance on the rocks and trees of the moist-wooded tropics, absorbing the various elements of their slowly decomposing humus.

Terrestrial Orchids grow at various altitudes, and are widely distributed throughout both hemispheres, the polar regions and arid deserts excepted. Many are deciduous and tuberous-rooted; some grow from underground rhizomes; others are pseudobulbous and deciduous, while not a few have reed-like stems. Examples of terrestrial Orchids are Catasetum, Calanthe, Cyrtopodium, most Cymbidiums, some of the Cypripediums, Disa, Goodyera, Govenia, Habenaria, Lissochilus, many Masdevallias, Microstylis, Neottia, Orchis, Pogonia, Peristeria, Phaius, Sobralia, Spathoglottis, etc., all of which should be sought under their special genus headings in other portions of this work for cultural directions. They differ very essentially in structure, and in



1574. Method of shading Orchid houses.

many cases require a special method of treatment for individual plants of the same genus, as Habenaria for example, where some are found growing in rich, turfy loam exposed to sun, while others inhabit wooded, swampy locations.

Many species of terrestrial Orchids nearly or quite defy successful treatment under cultivation from lack of knowledge regarding the mineralogy of their native habitats, or from the plants being practically saprophytic on certain species of decaying vegetation, or growing only in connection with the myecelium of special fungi, which may assist them in making proper growth.

The hardy species, where a general collection is grown, should be cultivated in pots in coldframes, as many need protection during winter and others require shade which can be supplied by painting the glass. Our native hardy species, however, do best planted out in a properly constructed rockery, laid out in pockets so that each may receive its proper compost.

The more tropical species—Cymbidiums, Cypripediums such as *insigne*, *Phaius grandifolius*, *P. maculatus* and *P. Wallichii*, Sobralias and some other evergreen species—thrive best in the Mexican or cool end of the Brazilian house.

Anæctochilus, tropical Goodyeras and Cypripediums, Spathoglottis, and several genera of like nature, require the same general treatment as epiphytal Orchids, with temperature of the East Indian department at all seasons.

Bletias, Catasetums, Cyrtopodiums, Calanthes, many Lycastes, tropical Liparis and Microstylis, *Phaius Humblotii* and *P. tuberosus*, Thunias and many other deciduous and semi-deciduous species, should be grown in the East Indian, or warm end of the Brazilian department, and during the resting period should be placed

in the Mexican department, allowing them only sufficient water to keep the plants in sound condition.

Epiphytal Orchids are found chiefly in the humid forests of tropical countries, often along streams where they receive their condensing moisture during the dry season. A few grow in open grassy situations or among brush. These consist chiefly of climbing Epidendrums of the *E. erectum* section, a few Oncidiums of the caulescent type (the distance between the pseudobulbs often denoting a year's growth), and some of the terete Vandas, etc.

Aërides, Phalænopsis, Vanda and the epiphytal Cypripediums are distributed throughout India, Malay Peninsula, Cochin China, Celebes, Borneo, Philippine Islands, Java and some of the Oceanic islands, usually following the moist forests of mountain ranges, occasionally at high elevations. With one or two exceptions, as *Vanda cærulea*, all do satisfactorily in the East Indian department, reserving the warmest part for Phalænopsis, which as a rule grows nearest the sea-level.

Angræcums are natives of Madagascar and tropical Africa, with one isolated species, *A. falcatum*, which is from Japan. They grow in humid, shady locations, where they can receive a copious supply of water at all seasons, and are closely allied to Vanda, requiring the same general temperature and treatment.

Dendrobiums are most common throughout India, Moulmein being a central district, but they are also plentiful and widely distributed throughout eastern Australia, New Guinea, the islands of the west Pacific and Oceanica under various climatic conditions. A majority of them, especially the deciduous species, are subjected to long droughts and long resting periods, but as they lose their foliage at that time their evaporating surface is reduced to a minimum, and the effect of the dry heat through the day is more than counteracted by heavy dews and the condensing vapors, which arise during the early mornings in those countries.

Bulbophyllums and Cœlogynes have their homes principally in the mountainous forests of East India and Borneo, where they are copiously supplied by frequent rains. Nearly all grow best in the Brazilian department.

Cattleyas and Lælias inhabit the humid forests of the various mountain ranges of tropical America, from Mexico south through the U. S. of Colombia to Peru, the North Amazon valley, through Venezuela and Guiana, and the mountain belt of eastern and southern Brazil, usually at an altitude of 2,000 to 5,000 ft., excepting the Mexican species *L. albida*, *L. anceps*, *L. autumnalis* and *L. majalis*, which grow at from 5,000 to 8,000 feet, commonly among Polypodium fern.

Cattleyas and Lælias grow on rocks and trees often devoid of other vegetation along the margins of rivers and ravines usually in shade, where they receive a copious supply of water from heavy dews and condensation of morning fogs which saturate the forests during the dry season, and often excessive rains while growing. They should be grown in the Brazilian department, excepting *Cattleya citrina*, the Mexican Lælias and *L. Jongheana*, which thrive best in the Mexican department or warm end of the New Granadan house.

Stanhopeas are found from southern Mexico south to Peru, Venezuela, Guiana and Brazil at rather low elevations, often in dense forests, the individual species having a very wide range. The Brazilian house affords them the best temperature, but they may be grown in any of the departments with success.

Epidendrum is a large and varied genus, widely distributed throughout tropical America, from South Carolina to southern Peru, and one of the few epiphytal genera inhabiting the United States. They are found at all elevations from sea-level to 10,000 ft. or more. The writer found *E. Ibaguense* growing in quantity on the margin of perpendicular clay ridges fully exposed to the sun at this altitude in the U. S. of Colombia in a robust, healthy state, and the same species below 5,000 feet in the same condition. Many of the individual species cover a wide range of distribution. They require the same general treatment as Lælias and Cattleyas. Few species are worthy of cultivation except for botanical purposes.

Maxillarias cover much the same range as the last genus, but are not quite so widely distributed. They grow equally well in either the Brazilian or Mexican departments.

Oncidiums are distributed along the mountain ranges from southern Mexico to Peru, in the southern and northern portions of Brazil chiefly along the coast, the Spanish Main and Islands of the Caribbean sea. The *O. Carthaginense* and *Papilio* sections are found at sea-level and seldom above 500 ft. elevation. These grow best in the Brazilian house. Nearly all of the other species may be grown in the Mexican department, except a few, such as *O. cucullatum*, *O. Phalænopsis* and the *O. macranthum* section, which are found at high altitudes; these should be grown in the New Granadan department.

Odontoglossums follow the higher wooded mountain ranges from southern Mexico, Central America and the Central Andes of U. S. of Colombia south to Peru and the northwestern portion of Venezuela, all at high altitudes. They usually grow in the moist shady forests, where the rainy season is long continued or condensing fogs and dews are very heavy, keeping many of the species in an almost perpetual state of saturation, their only relief of excessive moisture appearing to be from the frequent heavy winds that prevail in these regions. The Mexican species grow well in the cool end of the Mexican department, while those of the *O. luteo-purpureum* and *crispum* type require the new Granadan house.

Lycastes are distributed from southern Mexico to Peru along the mountain ranges, usually at an altitude of 4,000 feet in rather shaded locations; they are most common from southern U. S. of Colombia to their northern limit. *L. tetragona* is from southern Brazil and far removed from the general area of distribution, with little resemblance to any other species. Its 4 angled monophyllous pseudobulbs produce semi-pendent scapes carrying often as many as eight flowers, not unlike a Cymbidium in general appearance. Lycastes grow well in either the Mexican or New Granadan department.

Selenipediums are the South American representatives of Cypripedium. They are distributed from Costa Rica south to Bolivia, through Venezuela, Guiana and eastern Brazil, at from 3,000 to 8,000 ft. elevation, in wet marshes and on the branches of trees in shaded forests, in all cases where they get a bounteous supply of water at all seasons. The Brazilian or Mexican department suits them equally well.

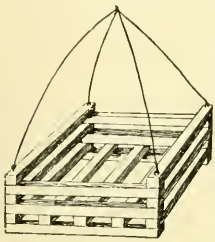
Masdevallias, Restrepias, and Pleurothallis grow at high elevations in Venezuela, Mexico and south to Peru, with a few in the Organ mountains of Brazil, their principal center being U. S. of Colombia near the Odontoglossum district. They always follow the mountain ranges, growing on trees, rocks and on wet, marshy slopes, in extremely wet locations. The Chimæra section is found at the lowest elevation. They all grow best in the New Granadan department.

Newly Imported Orchids.—On arrival of cases of Orchids from their natural habitats they should be carefully unpacked as speedily as possible, in an isolated room where insect pests that often arrive in the cases may be destroyed, and laid carefully and loosely against one another, on the bench of a shady, well-ventilated house or packing-shed. Should they all be found in good condition, the pseudobulbous species, such as Cattleyas and Lælias, should be hosed over thoroughly and allowed to remain for about a week, at the end of which time they should be examined for any signs of decay and bruises. All such parts should be removed with a sharp knife. The plants should be cleaned and sponged to remove dust, potted or basketed, as the case requires, and placed in a shady portion of their respective departments, allowing them sufficient water to gradually start them into action, after which time they will require the same treatment afforded established plants of their kind.

Cypripediums, Masdevallias, Phalænopsis, Vandas, the Batemannia and Bollea sections of Zygopetalum and other non-pseudobulbous genera should be placed on damp sphagnum in a well-shaded, airy department for a week or ten days, without syringing, until it is ascertained what amount of damage they have received in transit. After sponging the leaves carefully and remov-

ing any decayed and bruised parts, they may be potted and basketed, and removed to their proper quarters, watering sparingly until they start new action.

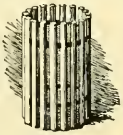
It is customary in some establishments to hang newly imported Orchids by the roots, tops down, from the roof of the house or beneath the benches until they show signs of new action, but they invariably suffer more or less from this practice and are better treated as above.



1575. Commonest and best style of basket for general culture of Orchids with pendulous scapes.

Pots, Baskets, etc.—Many Orchids are best cultivated in the ordinary earthen pots and pans, more especially terrestrial species and a few of the epiphytal kinds, which grow on rocks in marshes, and among quantities of humus and fern roots. A majority of the epiphytal species, however, need special structures that will admit air to circulate freely to the roots; otherwise, these are liable to decay through excess of water if confined in close pots when inactive during winter, which must eventually weaken the constitution of the plants.

Figures 1575–1583 fairly illustrate the best and most practical pots and baskets for successful culture. Fig. 1575 shows the Orchid basket most commonly used; it is the best adapted for the general culture of Cattleyas, Coryanthes, Dendrobiums, Epidendrums, Lælias, Masdevallias of the Chimæra section, Oncidiums, and a majority of Orchids with pendulous flower-scapes. They can be made of cedar, teak-wood, cypress, or any durable wood. The wood is cut into square (or round) sticks of any length desirable and in proportionate thickness from ½–1 in., and carefully perforated at each end. Through the holes is inserted a strong wire, which is looped at the upper end when finished in order to receive the wire hanger. These baskets can be as deep as desired, but three sticks on each of the four sides are usually enough for most Orchids, with two or three placed crosswise through the bottom, to hold the compost. The hanger is made by twisting together and bending down in the middle two pieces of galvanized or copper wire, forming four ends to insert in the basket-loops and a loop or hook at the top by which to suspend it.



1576. An Orchid cylinder.
Used for very tall species.

The Orchid cylinder (Fig. 1576) is very useful for standing on the bench or pit, and is used for Renantheras, Aërides, Vandas, Angræcums, Epidendrums, and many other tall plants that are too tall or difficult to suspend. Cylinders are made in all sizes and any diameter desired, with either square or round sticks. They are bored a short distance from the ends and a wire inserted through them, with a small block between each stick, to make an opening for air. When large enough the sides are brought together and fastened. The depth is adjusted by movable cross-pieces.

1577.
An Orchid raft.
Used for much the same purpose as the cylinder.

The Orchid raft (Fig. 1577) is made in much the same way as the cylinder, but is left flat with the openings between closer together. Oblong-square blocks of hard, rough wood, an inch or less thick, answer much the same purpose. The Orchid raft or block is very useful for many species, such as *Cattleya citrina*, Barkerias, *Epidendrum falcatum*, *Dendrobium Jenkinsii*, *Oncidium Limminghii* and *Papilio*, Scuticarias, etc.

The earthen basket (Fig. 1578) is useful when the compost is fine and when the roots do not require much atmospheric action; also to properly mature tissue in a few terrestrial species, thereby inducing them to flower more freely. The earthen basket is especially useful for Acinetas, Peristerias with pendulous scapes, Stanhopeas, etc.; it is made with ovate openings around the sides and a round one in the center to admit pendulous scapes.

The perforated pan (Fig. 1579) is usually made only in small sizes and used for Bulbophyllums, the concolor type of Cypripedium, Dendrobiums, and many other small-growing species that do well suspended from the roof.

The perforated Orchid pot (Fig. 1580) is for bench use and is useful for many epiphytal Orchids that are not to be suspended, the perforations or holes supplying abundant air to the roots, a safeguard against losing them through overwatering in winter.

1578.
Earthen basket.
For Stanhopeas and other Orchids, whose pendulous scapes issue through the holes in the bottom.

Figs. 1581 and 1582 show the standard earthen pot and pan for terrestrial species. They should have the drainage holes made on the side at the base, instead of directly underneath, as a preventive against earth-worms entering from the benches.

Potting, Soil, etc., for Terrestrial Orchids.—Terrestrial Orchids as a general rule grow best under pot culture. Potting material for the following genera—Acanthephippium, Bletia, Calanthe, Cymbidium, *Cypripedium insigne* and most of the hardy species, Cyrtopodium, Habenaria, Liparis, Microstylis, Peristeria, Phaius, Pleione, Sobralia, Thunia, and some others—should consist of about one-third each of chopped sod with some of the fine soil removed, chopped live sphagnum and leaf-mold, adding a little ground bone for some of the strong-growing kinds. One-third of the pot space should be devoted to clean drainage, covered with sphagnum or rough material to keep it open. After removing all decayed portions, the roots should be carefully distributed and the compost worked in gently but firmly around them, leaving the surface a little convex and slightly below the rim of the pot as in Fig. 1581 (the dotted lines denote drainage required). The convex surface gives the rhizome an opportunity to dry out frequently, thus avoiding fungi, which are troublesome to some species.

In repotting terrestrial Orchids sufficient pot room should be given to last a year or two if possible, as they dislike to have their roots disturbed oftener than is necessary. The best time to repot is just before the rooting period, or when they are starting their new growths in spring. The deciduous species of Calanthe can be easily increased at this time, if desired, by removing the old bulbs and placing a number together in a pan or shallow box, covering them partly with compost and placing them in a warm house until they start action, after which time they should be potted as desired, two or three together.

1579.
Perforated pan.
Adapted to small Orchids that do well when suspended from the roof.

Anœctochilus, Arpophyllums, Cypripediums, Disas, Goodyeras, Spathoglottis, and many allied genera, grow best under pot culture, but otherwise require compost and treatment similar to the epiphytal kinds.

Potting, Basketing, and Compost for Epiphytal Orchids.—The roots of epiphytal Orchids are usually very porous, and many are covered with a corky substance (velamen), capable of absorbing and retaining water for considerable time. In their native homes a great many of the roots are aërial or grow in loose, fibrous material, such as moss and the fine roots of Polypodiums and other ferns, where they have free access of air at all times. It is important that they receive similar treatment un-

der cultivation so far as is consistent, with the difference of their environment taken into consideration. Thus it is apparent that one of the special features in the culture of epiphytal Orchids lies in the proper selection of compost and the method of potting and basketing for the best results in after-cultivation.

1580. Perforated Orchid pot.

Adapted to epiphytes which need plenty of air at the roots and are in danger of over-watering.

Peat fiber, sphagnum moss and leaf-mold constitute the principal materials of good compost, usually lasting one or two years without renewal, which is important, as the roots suffer more or less in being disturbed. By peat fiber is meant the fibrous roots of various wild ferns, with the fine soil removed by first chopping it into small pieces, then rubbing it across a coarse sieve. The several species of Osmunda furnish us with the best Orchid peat. The sphagnum moss used for Orchids should consist of *Sphagnum squarrosum*, *S. macrophyllum* and the coarse-leaved species only; *S. acutifolium* and other weak-growing species should never be used, as they soon decay and become detrimental to the roots.

Leaf-mold is made from decomposed leaves. The leaves of almost any tree will do, but those of hard-wood trees are most desirable, especially oak. When collected in the fall the leaves should be heaped up to decay for a year or more, and turned over at least twice during that time.

Charcoal is the best material to use for drainage and for mixing or interspersing with the compost. It is best made from hard wood and should not be over-burned. Broken potsherds are often used, but they are not as good; being porous, they either absorb too much water at times or become overdry too often and are liable to prove injurious. Charcoal is lighter in weight, and contains more useful properties.

1581. Standard earthen pot.

For terrestrial Orchids, with drainage holes at the side instead of at the bottom.

Where closed pots are used, nearly one-half of the space should be devoted to drainage and the balance to compost, consisting of about equal parts of peat fiber, chopped sphagnum and leaf-mold for most genera, adding a few pieces of charcoal in potting, and a piece beneath the rhizome of the tender ones. Care must be exercised in potting to distribute the roots properly and make the compost moderately firm about them, leaving the finished surface convex, to throw off surplus water and protect the rhizome from an over-abundance of wet. Top dressing with live sphagnum is beneficial to many Orchids, such as *Odontoglossum crispum* and allies, and gives the surface a neat appearance. Fig. 1583 illustrates a finished pot, the dotted line in Fig. 1581 indicating the amount of drainage required.

When perforated or open-work pots or baskets are used, no direct drainage is necessary. Rough, broken pieces of charcoal should be freely used in the compost while potting, as it helps to keep the mass firm and the roots of nearly all species attach to it freely; also it lessens the quantity of compost and so modifies its texture as to allow it to dry out more readily than when packed in a solid body.

1582. Standard earthen pan.

For terrestrial Orchids, showing side drainage holes.

Cattleyas of the *C. intermedia* type, Coryanthes, Cypripediums of the *Lowii* and *Stonei* sections, some Dendrobiums, *Oncidium Carthaginense*, *O. crispum*, *O. macranthum*, *O. Papilio* and their allies should have the leaf-mold omitted, while Aërides, Phalænopsis, Saccolabiums, Vandas and kindred genera require only chopped live sphagnum and charcoal as a compost.

Watering, Humidity.—It is impossible to lay down any hard and fast rules for watering Orchids. Watering is a very important operation and requires more or less practical experience, connected with a knowledge of the general conditions surrounding the plants in their native homes. As a rule most Orchids need a liberal supply while growing, but the condition of the plant and compost and the manner in which it is potted or basketed have much to do with this.

The evergreen terrestrial species, which grow chiefly in loam fiber, as Cymbidium, *Cypripedium insigne*, Phaius, Sobralias, etc., require water whenever the surface of the compost is becoming dry, with occasional light overhead syringing in fine weather, which will assist in keeping down red spider, thrips and other pests. An occasional application of weak liquid cow or sheep manure is of great benefit while the plants are growing.

The deciduous species have a decided period of rest, at which time they are practically inactive and need very little water, enough only to keep the stems and pseudobulbs in sound condition. When growing, however, they require a good supply and should have a thorough watering to the bottom whenever the soil is becoming dry, but should not be kept in a wet condition at all times, or the soil soon becomes sour and infested with worms, under which condition no Orchid can do well.

Epiphytal Orchids, or a greater part of them, in their native habitats grow in locations where heavy rains are frequent or of almost daily occurrence during their growing season, and where condensing vapors settle on them like dripping rain, while the early morning fogs rise among the forests, charging the atmosphere almost to saturation during the early part of the day in the resting season. Such species as are subjected to a severe dry resting season are often deciduous (see *Dendrobium*, and also p. 1166). Many of the extremely alpine species, such as the Masdevallias and *Odontoglossum crispum*, are subjected to two annual rainy seasons, and where these seasons are much prolonged the undersigned has observed the last-mentioned species in its native habitat mature as many as three pseudobulbs in the year. Thus the pseudobulb is no indication of annual growth, but a reservoir of supply in case the plant is overtaken by severe or sudden droughts, each pseudobulb being supplied with a mature secondary bud for further reproduction should the proper lead be destroyed.

1583. Method of potting an epiphytal Orchid.

Showing the raised and round top of sphagnum.

Such genera as Aërides, Cypripediums, Masdevallia, Vanda, etc., which have no pseudobulbs, rely more or less directly on a daily supply at all seasons. These, with many of the extreme alpine species, should have a liberal supply of water at all times.

Many of the pseudobulbous kinds, including Cattleyas and Lælias, are also constantly in action perfecting new roots or maturing their flower-buds, after the pseudobulbs are completed and they are apparently at rest. For this reason careful observation of each species is necessary to make their cultivation successful.

Under basket culture there is least liability of injury through overwatering, and excepting genera like the Oncidiums and Dendrobiums (which need a dry and cool resting period to induce them to flower), and deciduous species at rest, nearly all should receive a good supply of water, weather permitting, whenever the compost is becoming dry, with frequent syringing overhead in fine weather, when the temperature is normal and ventilation can be given. A stimulant of weak sheep or cow manure applied occasionally to plants in action will benefit them.

On cold, cheerless days, when the temperature is below normal and the atmosphere is overcharged with moisture, very little watering or damping is needed, and unless it be some particular species which cannot endure drying, or tiny seedlings, it is safest to withhold water, as at these times the stomata cease action and the plants become overcharged with water; thus those with weak constitutions and immature growths are liable to attacks of wet-spot and rot. The best means of coun-

teraction in such cases is to apply fire heat and ventilation. A close, stagnant atmosphere is always to be avoided.

As a safeguard against excessive changes in humidity a hygrometer should be kept in each department to ascertain and regulate the degrees of moisture, especially during fall and winter. When overabundant, moisture can be reduced by applying fire heat and ventilation, and if insufficient by wetting down the paths and shelves, or pits, and reducing the ventilation. Well regulated departments should be kept as near as possible to 70° or 75° through the day or 80° to 85° with free ventilation, and about 80° at night. Just after damping and watering it will often rise to 85°, but this is of no consequence, as it soon recedes. Orchids at rest, such as Calanthes and Dendrobiums, should be held at 65° to 75°. In no case, where it can be avoided, should it go below 60° nor rise above 90° for any length of time, as serious results are very liable to follow.

Ventilation.—The ventilators should extend the entire length on both sides of the ridge, and be supplied with the best modern lifting apparatus. Extending them continuously along the roof necessitates raising them but a small height to afford proper circulation to the plants and egress of overheated air, without losing too much moisture. Having them on both sides assists in avoiding direct drafts, by using the side protected from the direct wind.

One essential point to be considered is this: When should ventilation be applied so as to be of the most possible benefit to the plants? Air must be given at all times, when possible, to keep the atmosphere active, as well as to lower temperature, also to reduce the density of moisture when excessive in close, inclement weather and during the night. In bright weather ventilate enough to allow egress of the heated air.

It is customary with some cultivators to close down ventilators in wet weather and during the night to help retain heat, etc. This is a serious mistake. It may show no visible injury in bright weather, when the density of moisture in the atmosphere is at a minimum, but this bad practice surely accounts for the decaying of many young growths, which are lost during wet, close and cloudy nights.

Propagation.—Many species of Orchids can be propagated by division and from cuttings. This is usually resorted to when it is desired to increase the stock of rare and unique species and varieties. With the more common species, however, it is cheaper and better to buy freshly imported stock, as it often takes two, three or more years to bring the young plants up to the flowering stage.

The pseudobulbous species, such as Cattleyas, Odontoglossums, Cœlogynes, etc., are propagated by cutting part way through the rhizome three or more pseudobulbs behind the lead with a sharp knife. This will usually retard the sap and force the dormant eye behind the cut to grow. The back portion may then be removed and potted or basketed separately, or left on the plant to mature the new growth, and be removed when it starts action the following season.

With the deciduous Calanthes, the old bulbs should be removed when potting them in spring and put, several together, in pans or flats and partly covered with sphagnum or potting compost until they start to grow, when they should be potted in the regular way. Thunias are easily propagated after the young growths are well advanced, by cutting the last year's stems into pieces 4 or 5 inches long and inserting the ends in chopped sphagnum and sand, placing them in the propagating house until they grow, when they may have their normal heat. Dendrobiums are managed in much the same way, or the old canes can be laid on wet sphagnum, when many will produce new growths from the side eyes on the nodes. Aërides and Vandas are increased by removing the upper portion with a sharp knife, leaving a few roots and at least a foot of stem to each top. The old bases of the stems usually break new growths freely, often producing several new shoots from each. Cypripediums should be divided between the older growths, leaving at least one old growth with each lead, and potted separately, allowing them a little extra moisture until they start to grow. Masdevallias and allied genera can be separated in the same manner, leaving several leaves and one or more new growths or leads to each piece. All species should be propagated at the commencement of the growing season.

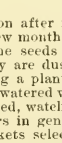
Reproduction of Orchids from Seed.—The reproduction of Orchids from seed through crossing and hybridizing has been carried on for many years successfully by a limited number of hybridists, principally abroad, and it is only within the past 10 or 15 years that it has received much attention in America, but in that limit of time very many beautiful hybrids have sprung into cultivation, and to the late firm of Pitcher & Manda, of Short Hills, N. J., much credit is due for the fine work they carried on in this line. Many of our establishments, both private and commercial, are now paying much attention to this branch of Orchid culture, with various degrees of success. The fertilization of Orchids is very easy and requires no special skill, but judgment should be exercised in the selection of proper species for the work, in order that the results may be an improvement over both parents, if possible.

The seed-bearing parent should possess a good, vigorous constitution, of free-growing and flowering habit, as the hybrids usually follow this parent in form of growth, and the pollen parent in color of flower. Fertilization is effected by placing one or more of the pollinia or pollen masses on the stigma of the flower to be fertilized, selecting always plants of relatively the same genus for the operation. Crosses between genera widely removed from each other in general character usually prove fruitless, for though the ovary may become stimulated by foreign pollinia and an apparently successful cross be effected, the seeds will either fail to mature or the results will follow the seed parent in every detail.

It takes about a year to ripen the seed of most Orchids in our climate, with exceptions in a few genera. Masdevallias mature in about six months and Selenipediums in about three months.

The seeds germinate best when sown soon after maturity, and many lose their vitality in a few months if kept too dry and warm. When sowing the seeds the best results are often obtained when they are dusted on the surface of pots or baskets containing a plant of the same genus as the seed and carefully watered with a very fine rose until they become attached, watching carefully for snails, slugs, and depredators in general that infest the compost. The pots or baskets selected should have a favorable-looking surface, with the compost in good condition, firm and free from fungi. Use pots or baskets that will not have to be disturbed for a year or more, as it often takes that length of time for the seedlings to come through. Seed sown in early spring seems to germinate soonest. The writer has had Selenipedium seedlings up in three months from sowing, and again has waited for Cypripedium twenty-three months before the seedlings appeared.

After the seedlings have perfected 2 or 3 leaves it is quite safe to remove them to small pots, singly, or several to a small pan, using compost of the same material as that for the parent, but cut a trifle finer.



1585. Three months from seed, and ready to transfer to a pot. (*Cypripedium insigne*, var. *Sanderæ*.)

Many tiny seedlings are lost shortly after germinating, through the soil becoming sour or through fungi. When thus attacked they should be transferred to other pots or baskets not infested.

1584. Newly germinated seedling. (*Phaius hybridus*.)

Fig. 1584 illustrates a newly germinated seedling of *Phaius hybridus*; Fig. 1585 a three-months-old seedling of (*Cypripedium insigne*, var. *Sanderæ*, in proper condition to be transferred to a pot; Fig. 1586, eight-months-old plant of *Phaius Wallichii*; Fig. 1587 a twelve-months-old hybrid Cattleya (*C. intermedia* × *C. labiata*); Fig. 1588 a Cypripedium thirteen months old; Fig. 1589 a two-year-old hybrid between a Cattleya and Lælia (*C. intermedia* × *L. præstans*).

The raising of Orchids from seed should be encour-

aged, and enlist the energy of every Orchid culturist, not necessarily for the production of hybrids alone, but also for the reproduction of rare species and varieties, and a number of species which are fast decreasing or becoming extinct in their native homes. Aside from the financial inducement offered the commercial grower, it will prove instructive to the botanist and afford infinite pleasure and pastime for the amateur.

Diseases.—Orchids are subject to many diseases. Those having importance from a cultural standpoint and most troublesome to the grower are known as wet- and dry-rot and spot. Wet-rot is caused by an overmoist or stagnant atmosphere, and is usually first detected by a semi-transparent appearance of the parts affected, which soon become dark brown. It spreads slowly along the tissue. If noticed at the commencement it can be readily checked by slitting the epidermis with a sharp knife and removing the plant to a more airy position in the house for a few days. Dry-rot is caused by a fungus which attacks the rhizome of the plant. It is often produced through burying the rhizome or base of the plant with compost. Cypripediums are subject to it. Large, healthy growths when attacked quickly show a sickly pale color in the foliage, which, on examination of the base, will be found discolored, and with a light brown appearance. If the portion attacked is quickly removed with a sharp knife it will usually give no further trouble; otherwise it will travel through the entire rhizome and destroy the plant in a very short time.

Spot comes from various causes: the appearance of small dark brown spots on the succulent leaves and pseudobulbs is usually an indication of cold and overwatering. Spot also arises through weak tissue, especially in Phalænopsis, Saccolabiums and Angræcums during winter, which have been grown too warm, shady and moist. The affected parts should be slit with a sharp knife and a little flowers of sulfur should be rubbed over the wound. When they make new growth the plants should be placed in a brighter and more airy position to induce a better growth. The brown dots which make their appearance on the leaves, especially at the apices and on new growths of deciduous and plicate-leaved species, indicate either lack of sufficient water at the roots or an overdry atmosphere, both of which conditions can be easily changed.

Snails and Insects.—Orchids are attacked by many forms of snails. Insect pests are a great annoyance to the cultivator. They can be kept in subjection only by constant attention. Slugs and shell snails are very destructive. If allowed to increase they devour young shoots, roots and flower-buds. The best means of capturing them is to place saucers of dry bran on the shelves among the pots, and look them over morning and evening. By this means many will be destroyed. Various species of scale insects attach themselves to the leaves, pseudobulbs and rhizomes of nearly all species of Orchids, and can be eradicated only by the use of a soft brush and washing with a sponge and water. A little whale-oil soap added to the water is of great assistance, and also useful in destroying red spider and green and yellow fly. Black and red thrips attack the young growths of many species and often become very troublesome. Fumigating the houses with tobacco stems lightly about three times during the week will soon cause them to disappear. Fumigation is also a sure remedy for green fly.

1586. Eight months from seed. (*Phaius Wallichii.*)

1587. A year from the seed. (*Cattleya intermedia* × *C. labiata.*)

1588. Thirteen months from seed. (*Cypripedium.*)

The Cattleya fly is very injurious to young growths of Cattleyas, Lælias and some Epidendrums. The flies lay their eggs in the very young growth at the base, causing an enlargement which is easily distinguished. The only remedy is to remove the growth, and burn it. The mature fly can be eradicated by fumigating the house with tobacco stems about three times each week during early spring.

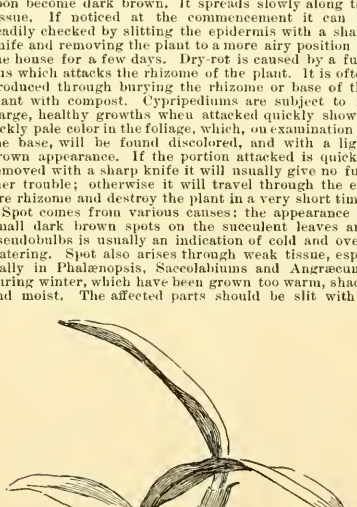
The Dendrobium beetle larva burrows in the stems of various species of the genus, and is detected by a small discolored spot. There is no remedy, except to cut away and destroy the parts attacked. An insect which is much more to be dreaded is the Dendrobium mite, which perforates the canes and rhizomes of Dendrobiums and many other Orchids, laying a number of eggs in each perforation. On hatching, these eat away a part of the plant around them, causing that portion to decay. They can be found only by careful and close observation, and this often after the plant is beyond redemption. There is no remedy but cutting them out, and unless the plant attacked is valuable it is best to burn it and keep the pest from spreading.

Mealy bug is usually not very troublesome to Orchids. It is readily seen and destroyed without much injury to the plant.

Roaches are usually very troublesome, and hard to eradicate, as they feed at night and remain hidden through the daytime. They destroy roots, growing shoots and young flower-buds and scapes. Bran, powdered sugar and Paris green, mixed together and placed around the houses in saucers, will usually keep them in subjection, and they should be hunted down at night by the aid of a lantern. Many can be caught in this manner.

Sow bugs or wood lice are usually common in every part of Orchid houses, pots and baskets. They do a great deal of damage to young leaves, roots and the tender portions of flower-scapes. The Paris green mixture used for roaches is very effectual in reducing their number, but it is impossible to be entirely freed from them.

ROBERT M. GREY.



1589. Two-year-old hybrid between a Cattleya and Lælia.

Cypripedium concinnum, var. superbum

Zygopetalum crinitum

Trichopilia suavis

Lycaste Skinneri

Cattleya Dowiana

Miltonia Roezlii var. alba

Cœlogyne cristata

Dendrobium nobile

Some genera of Orchids

ÓRCHIS (Greek word, referring to the shape of the tuberous roots of certain species). *Orchidàceæ*. Orchis is the typical genus of the great family of Orchids. It contains about 70 species, all terrestrial and natives of the northern hemisphere, chiefly in Europe and Asia, with 2 species in North America. Plants perennial by means of simple or palmate tubers: stem simple, erect, terminating in a raceme or spike, with few to many rather small fls., and bearing several lvs., with long sheaths; bracts often foliaceous: sepals all similar, connivent or spreading: petals often smaller, entire: labellum 3-lobed, middle lobe entire or parted, base spurred: column very short or none: stigma plane, not produced (Habenaria).

Orchises are not showy, and they have no horticultural standing, but lovers of our native Orchids are always collecting them and trying to cultivate them, usually with little success. F. W. Barelay writes: "The American species of Orchis are woodland plants, requiring rich leaf soil, with rather heavy shade, and that even condition of moisture characteristic of deep woods. Where these conditions cannot be supplied the plants invariably prove short-lived." See also discussion on terrestrial orchids, page 1165.

hircina, Crantz (*Himantoglóssum hircínum*, Spreng.). Flower stems 1–2 ft. high, bearing a loose raceme 4–8 in. long: fls. greenish white, exhaling a disagreeable odor; middle lobe of the labellum long, strap-like and twisted, lateral lobes much smaller: lvs. few near the bottom of the scape, oblong-lanceolate. May, June. Europe and northern Africa. Advertised by Dutch bulb-growers.

spectábilis, Linn. Fig. 1590. A native species with 2 large obovate, shining lvs. 4–8 in. long, borne near the ground, and a stem 4–7 in. high, bearing a raceme of 3–6 small pale purple and white fls. April–June. In rich woods, northeastern U. S.

The following species are advertised in America by European dealers, but are not known to be cultivated in America. Most of them are hardy European plants. The synonomy of the group is somewhat confused. *O. Brauniórtii*, fls. purple.—*O. foliósa*, large, leafy spikes of purple fls.—*O. fúsca*, purple- and rose-colored fls.—*O. latifólia*, spotted lvs. and purple fls. *O. longicórnis*, fls. rich purple. North Africa.—*O. maculàta*, fls. lilac-purple.—*O. máscula*, fls. purple, in long spikes.—*O. militáris*, fls. purple.—*O. Mório*, fls. purple and green.—*O. pállens*, pale sulfur-yellow.—*O. papilionácea*, fls. purple and white.—*O. pruinicátlis*, long spikes of pale lemon-yellow fls.—*O. Robertiàna*, fls. purple, brown and white, in large spikes.—*O. sambucina*, fls. yellow.—*O. undulatifólia*, fls. white- and rose-colored.

HEINRICH HASSELBRING.

ORCHIS, Rein. *Habenaria*.

OREGON, HORTICULTURE IN. Fig. 1591. Oregon, located between 42° and 46° 15′ N. and 116° 45′ and 124° 30′ W., with an area of 94,560 square miles, has, horticulturally speaking, four quite distinct districts,—the valleys of the Rogue, Umpqua, Willamette and Columbia rivers, together with their tributaries. There is climatically a very wide difference between these various sections. In the Rogue river valley the annual rainfall is 20–35 inches. The mean temperature for the winter months is 39°, spring months 57°, the summer months 67°, the autumn months 52°. The Umpqua valley has a rainfall of 22–43 inches. The average temperature for the seasons in the same order as the above is, 41°, 51°, 65°, 54°. In the Willamette valley the rainfall is 35–50 inches, the average temperature, 41°, 50°, 63°, 53°. In the Columbia valley it ranges from an average rainfall of 75 inches, in the lower part, to one of 15 inches in the upper part; and the temperature as above ranges from a mean annual average of 50°, varying from 39°–61° for the lower part, to one of 48° for the upper part, with hot summer months and cold winter months.

Not only does the difference of climate exist, but there is also a corresponding difference in the character of the soils of these different localities. In the Rogue river valley the soil is largely one of decomposed granite. A warm and open soil predominates, though in places the soil is remarkably heavy and of the same origin as a large part of the soils of the state, namely, basaltic. In the Umpqua valley the soil is generally of a medium character; clays predominate on the hills and on the higher parts of the valley proper, while on the river bottoms sand and open sedimentary soils are the more common. In the Willamette valley the soils are generally heavy, though there are occasionally streaks of light sandy or gravelly soil, usually along the streams. The soils of the Columbia region embrace all grades, from the light drifting sand of its upper basin to the cold clays of its lower basin.

The transportation facilities are good in all these districts, except the Rogue and Umpqua valleys, which have only one railroad; while the other sections, except the extreme eastern portion of the Columbia basin, have both railroads and river transportation facilities.

In all these districts the hardy fruits grow to perfection one year with another, and this without irrigation, though in some of the newer territory being tested for horticultural purposes irrigation is practiced.

The apple finds in Oregon a most congenial home, and while only a small part of the crop is marketed it is in no wise due to the climate and soil. Our best varieties are Baldwin, Esopus Spitzenberg, Ben Davis, Newtown Pippin, Red Cheek Pippin, Northern Spy, and Jonathan. The apple thrives best in the higher altitudes and especially in Hood river valley, an offshoot of the Columbia river valley, and in the Rogue river valley. Lately car lots have been shipped from the hitherto little known sections of eastern Oregon.

Pears grow to perfection in all parts of the state. The Bartlett, White Doyenne, Winter Nelis, Duchesse

1590. Orchis spectabilis (×½).

d'Angouleme, Easter and Clairgeau are the leading varieties.

The peach grows vigorously and fruits in the more favored portion of all districts, i. e., sheltered places along the river bottoms. But in the Rogue river valley, and to a limited extent in upper Columbia valley, it is grown as a commercial crop. Large quantities of the choicest fruits are shipped to the Willamette valley towns, two hundred and fifty or more miles by rail. The leading varieties are early and late Crawfords and Salway. In the upper Columbia region the Crawfords and Salway are favorites.

The cherry reaches perfection in Oregon's mild, moist climate, and especially the sweet cherries. Such varieties as the Napoleon, locally known as Royal Ann; Lewelling, locally known as Black Republican, and several local seedlings, as the Lambert, Hoskins, Occi-

dent and Lake, develop into the choicest of fruits. The Late Duke, Late Kentish, Richmond and Montmorency Ordinary, in fact all cherries, do well, though these latter are of no particular commercial importance.

The plums, and especially those varieties of *Prunus domestica* which have come into general cultivation

1591. Oregon, showing, by the shaded areas, the horticultural regions.

in the more favorable sections of the country, thrive throughout the state, though there are particular localities where those varieties cultivated as prunes do much better than in others. As a commercial crop the prune has become of much importance to the state, the output for 1898 on a conservative basis being put at 400 carloads of 30,000 pounds each and valued at 3¼ and 3½ cents per pound. For green fruit for local market the Yellow Egg, Peach, Columbia and Bradshaw are grown. Several attempts have been made to ship the Peach variety in a fresh state to the East, but thus far all such efforts have ended in failure. It will not keep long enough and stand up under the jar of transportation. For the prune crop two varieties are grown, the Italian and the Agen, locally known as the French or Petite. At present there is a much larger acreage of Italians than of Petites. There is a limited acreage of Golden Drop, locally known as Silver Prune, but as the tree is not robust, and as the fruit needs sulfuring before it is cured, this variety is given much less attention now than formerly, and only a limited quantity is grown. The curing of the prune is all done by means of driers or evaporators, of which there are numerous designs. (See *Evaporating of Fruits*.)

Of small fruits it may be said that they grow and fruit most abundantly in all parts of the state. Only about the larger cities are they grown as commercial crops, though at Hood river, which is a favored locality, large quantities of strawberries (the Clarke variety) are grown. In 1898 about fifty car-loads of these berries were shipped to the Rocky mountain states, returning to the growers something like $37,000. Blackberries, gooseberries, strawberries and raspberries do well in nearly all localities. Usually it is necessary to select favored sites for blackberries and strawberries: the former on account of water, our long, dry summers being uncongenial; the latter, on account of our heavy soils, will not generally do best on other than river bottoms or sandy ravines. Of currants the chief varieties are Cherry, Fay, White Grape and Black Naples; of blackberries the chief varieties are Lawton, Kittatinny, Erie; of the dewberry, Lucretia; of raspberries, Cuthbert, Gregg, Red Antwerp and Marlboro; of strawberries, Wilson, Sharpless, Clarke, Magoon and Everbearing; of gooseberries, Champion, Downing and Chautauqua. The wine grape is grown in southern Oregon and particular localities along the Columbia river, but the output can hardly be said to have commercial significance as yet, though it is rated as of excellent quality. During the past few years some large plantings of wine grapes have been made in the Rogue river valley.

In the Willamette valley the Moore Diamond, Concord, Worden, Delaware and Isabella are the most generally grown. Along the Columbia, the Sweetwater, the Muscats and Tokays are considered best. In southern Oregon both the American and foreign grapes flourish. The Mission grape of California, Sweetwater, Hamburg and Muscats fully mature in this section.

Chestnuts of the American and Japan varieties have been planted in numerous localities, and are just beginning to bear fine crops. French walnuts and filberts are likewise grown in many localities by amateurs, and much interest is being manifested in this fruit and in the near future commercial plantings will undoubtedly be made. From the experience of the past and the character of the nuts produced, it is confidently predicted that the nut crop of the future will be one of much value on the foothill land of the state. The almond, the apricot, the black fig and the loquat grow and fruit quite freely in the southern sections of the state. The cranberry thrives along the coast, and there are a few small bogs under cultivation in favorite spots.

E. R. Lake.

OREÓCOME. See *Selinum*.

OREODÓXA (Greek, *mountain glory*). *Palmàceæ*. This genus includes the Royal Palm, the pride of Florida, and the only tall palm native within the borders of the United States before the annexation of Porto Rico and Hawaii; also the Cabbage Palm, which is cut down when three years old for the central leaves, which are tender and edible. Oreodoxa contains 5 species of pinnate palms from tropical America. The nearest cultivated allies are Enterpe and Acanthophœnix, but in these the petals of the pistillate fls. are free, while in Oreodoxa they are grown together at the base. Oreodoxas are spineless palms, the solitary, erect, robust trunk cylindrical or swollen at the middle: lvs. terminal, equally pinnatisect; segments narrowly linear-lanceolate, narrowed at the apex, unequally bifid; midnerve rather thick, scaly beneath; margins not thickened, recurved at the base; rachis convex on the back, sulcate toward the base, and acute toward the apex above; petiole half-cylindrical, sulcate above: sheath long: spadix rather large, with long, slender, pendent branches: spathes 2, entire, the lower semi-cylindrical, equaling the spadix, the upper ensiform, ventrally fissured: bracts and bractlets scaly: fls. small, white, in scattered glomerules: fr. obovoid or oblong-ovoid, small, violet.

Of the Royal Palm Reasoner writes: "It is one of the grandest of pinnate palms, growing to a height of over 100 ft., with immense, plumy, feathery leaves and a straight white trunk. It is a grand tree for extreme S. Fla. for avenue planting, and is valuable in all sizes, but especially when 4 ft. or over in height."

A. *Leaf-segments not wrinkled or wavy.*

B. *Trunk swollen at or above the middle.*

régia, HBK. ROYAL PALM. Fig. 1592. Caudex 40–60 ft. high: leaf segments 2½ ft. long, 1 in. or less wide, linear, acuminate: fr. ovoid, ½ in. Everglades of Fla., Cuba, Antigua. G.F. 9:155. S.S. 10:505. G.C. III. 17:239; 27:297. A.F. 12:311. G.M. supp. Oct. 1, 1892.

BB. *Trunk not swollen at the middle.*

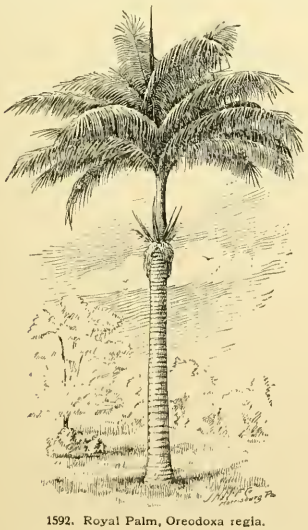
oleràcea, Mart. (*Arèca oleràcea*, Jacq.). CABBAGE PALM. Caudex 100–120 ft. high: leaf-segments lanceolate-linear, acuminate, 3 ft. long, 1½ in. wide: fruit obovoid-oblong, ¾ in. West Indies. Cult. in S. Fla.

AA. *Leaf-segments wrinkled and wavy.*

Sancòna, HBK. Stem 120–150 ft., smooth, glabrous, grayish black: lvs. pinnate; lfts. membranaceous: wood very hard, used in building houses. Colombia. Cult. only in S. Calif.—Franceschi says it has brownish leaf-stalks and is more tender than the other 2 species.

JARED G. SMITH.

OREOPÁNAX (i.e., *mountain Panax*). *Araliàceæ*. Some eighty species names have been referred to this genus, but the number of species is probably not one-half this number. In the trade, the species of Oreopanax are usually known as Aralias, but in the Aralia tribe the petals are imbricate in the bud, whereas in Oreopanax they are valvate. The Oreopanaxes are tropical American trees and shrubs, with simple or compound entire or toothed thick lvs., and fls. in dense heads which are arranged in racemes or panicles; calyx with minute or obsolete limb: petals 4–7, usually 5, the stamens of the same number and with ovate or oblong anthers: ovary 3–7-loculed, the styles rather long and bearing a flat, not thick, stigma: fr. globose and berry-like. Few species of Oreopanax are known in cultivation. They are hothouse subjects, requiring the treatment given tropical Aralias. Harms (Engler & Prantl, Pflanzenfamilien) divides the species into 3 gronps.—lvs. digitate, lvs. lobed, lvs. not lobed. The species described beyond are those which are now most often mentioned in gardening literature, but the writer has seen only the first in American collections.



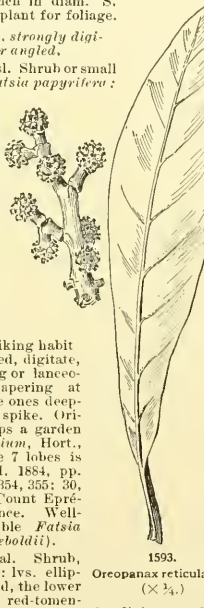
1592. Royal Palm, Oreodoxa regia.

A. *Lvs. all simple.*

reticulàtum, Decne. & Planch. (*Arália reticulàta*, Willd.). Fig. 1593. Small tree, with alternate, thick, entire, oblanceolate lvs. 12–18 in. long, somewhat revolute on the margin, strongly alternate-veined and reticulated with shades of green: fl.-heads spherical, nearly or quite an inch in diam. S. Amer.—A handsome plant for foliage.

AA. *Some of the lvs. strongly digitately lobed or angled.*

Sanderiànum, Hemsl. Shrub or small tree, with habit of *Fatsia papyrifera*: lvs. glabrous, thick and glossy, long-stalked, triangular-ovate in outline, on young shoots deeply 3-lobed but on flowering plants cordate and entire: fls. minute, in small, globose heads, which are arranged in racemose panicles. Guatemala. G.C. III. 13:451. A. F. 8:1283.



1593. Oreopanax reticulatum. (× ¼.)

AAA. *Some or all of the lvs. digitate.*

Epremesnilià num, André. Shrub of striking habit lvs. large, long-stalked, digitate, the leaflets 7–9, oblong or lanceolate and usually tapering at either end, the middle ones deep-lobed: fl.-heads in a spike. Origin unknown; perhaps a garden form of *O. dactylifolium*, Hort., in which each of the 7 lobes is usually lobed. R. H. 1884, pp. 320, 321. Gn. 29, pp. 354, 355; 30, p. 447.—Named for Count Eprémesnil, Dieppe, France. Well-grown plants resemble *Fatsia Japonica* (*Aralia Sieboldii*).

Andreànum, Marchal. Shrub, with variable foliage: lvs. elliptic to roundish, stalked, the lower surface and petioles red-tomentose, varying from angled to deeply digitate and the divisions pinnatifid: fl.-heads globular, in a terminal raceme. Ecuador. R.H. 1882, pp. 524, 525.

Thibaùtii, Hook. Small tree, stellate-pubescent on the young parts: lvs. long-stalked, 5-7-foliolate, the leaflets lanceolate or oblanceolate, entire, 6 in. or less long, dark green: fl.-heads ⅓ in. in diam., in a terminal raceme 1 ft. long. Mex. B.M. 6340.

pedunculàtum was once listed in Calif., with following description: "lvs. palmate, tinged with red; makes a fine foliage plant. Guatemala." It turns out to be *Kalreuteria paniculata*.

L. H. B.

ORÍGANUM (ancient Greek name said to mean *delight of mountains*). *Labiàtæ*. This includes several plants known as Marjoram which are fully described below from the popular and horticultural points of view. Botanically these plants are closely allied to the thyme, but the fls. of Marjoram are borne in heads surrounded by an involucre, while those of thyme are borne in few-fld. whorls which are axillary or spicate above.

Origanum is a genus of about 25 species of subshrubs and herbs mostly natives of the Mediterranean region. Whorls 2-fld., rarely 6–10-fld., crowded into globose or oblong spikelets: bracts colored and larger than the calyx, or green and smaller than the calyx; calyx various, 5-toothed or 2-lipped: corolla 2-lipped.

Authorities differ as to whether the common Pot Marjoram is *O. vulgare* or *O. Onites;* Vilmorin's Vegetable Garden holding to the first opinion, while Nicholson's Dictionary of Gardening and J. M. Thorburn & Co. take the latter. The two plants are very distinct, as the following

descriptions show, and the point can be easily settled by each reader for the particular plants which he is cultivating.

A. *Calyx of 5 equal teeth: bracts colored.*

vulgàre, Linn. WILD MARJORAM. Lvs. stalked, broadly ovate, subserrate, broadly rounded at the base, villous: fls. purplish, in corymbed clusters or short spikes.—Cult. in old gardens; also wild along eastern roadsides, being naturalized from Eu. B.B. 3:111.

AA. *Calyx 2-lipped: bracts not colored.*

B. *Lvs. stalked.*

Majoràna, Linn. Lvs. oblong-ovate, entire, tomentose: fls. purplish or whitish: spikelets oblong, 3–5 in a cluster.

BB. *Lvs. not stalked.*

Onites, Linn. Lvs. ovate, subserrate, villous or tomentose, mostly cordate at the base: fls. as in *O. Majorana* but a little larger: spikelets ovoid, very numerous in a cluster. Southeastern Eu., Asia Minor, Syria. W. M.

Origanum Majorana, Sweet or Annual Marjoram, is a native of the countries bordering the Mediterranean sea. It is an erect, branching perennial, bearing grayish green, rounded or oval leaves, small, whitish flowers in terminal clusters which appear in midsummer, and little, oval, dark brown seeds. The plant has a pleasing odor and warm, aromatic, bitterish taste, due to a volatile oil which is soluble in water, is officinally credited with tonic and gently excitant properties, and, as an infusion, is employed in domestic medicine to "bring out the rash" in such diseases as measles. More frequently than in medicine, however, its green parts are used as a condiment, being highly esteemed as a seasoning for soups, stews, meat pies and dressings. In the garden this plant is treated as an annual, hence the name "Annual Marjoram." This practice became necessary since the plants are prone to winter-kill unless carefully protected. Its propagation is also somewhat precarious, owing to the small size of the seeds and the tenderness of the seedlings when exposed to the sun. Shade, therefore, until the plants are well rooted is usually necessary. Successional plantings may be made throughout the spring; sometimes transplanting from hotbeds or coldframes in May or June is practiced. The plants should stand 6 inches asunder in rows 12 inches apart, in light, dry, but good soil, be kept clean throughout the season, and harvested for winter use just before flowering, the plant being cut close to the ground and hung in a cool, airy place to dry. If planted early, leaves may be gathered in late spring. According to Dreer, American-grown seed is better than imported seed for winter use, as it makes more bulk, while imported seed is better when the plants are to be cut green for summer use.

Origanum vulgare, Pot Marjoram, a branching, hardy perennial, about 2 feet tall, bearing in midsummer pink or purple flowers, and small, brown, oval seeds, grows wild on the skirts of European woods. The highly aromatic leaves and the young shoots gathered just before blossoming are used like those of Sweet Marjoram. The plant is of easy culture, succeeding in all warm garden soils. It may be propagated by seed, but, where established, division in spring or early autumn is generally practiced. The plants should be set 10 inches asunder in rows 15 inches apart, and kept well cultivated. Dwarf Pot Marjoram, a variety that comes true from seed, bears large heads of whitish flowers, and is often used as an edging plant.

M. G. KAINS.

ORÍXA (Japanese name). *Rutàceæ.* Deciduous shrub, with alternate, petioled, almost entire lvs., and greenish inconspicuous fls. It has proved hardy in Mass., but has no decorative merit besides its bright green foliage, which is not attacked by insects or fungi, and has a strong disagreeable odor like that of Ptelea. Orixa seems to grow in almost any soil. Propagated by greenwood cuttings; also by layers and root cuttings and by seeds. The genus has but one species. Fls. dioecious, appearing with the lvs. on the branches of the previous year; sepals and petals 4, staminate fls. in racemes, pistillate fls. solitary: fr. consisting of 4 dehiscent pods, each containing 1 black, subglobose seed. Pistillate fls. and fr. are described as solitary as stated above, and so they are on Japanese specimens, but a plant in the Arnold Arboretum has the pistillate fls. and fr. in short racemes.

Japónica, Thunb. (*Celástrus Orixa,* Sieb. & Zucc. *Ilex Orixa,* Spreng. *Othèra Orixa,* Lam.). Shrub, to 8 ft., with spreading branches pubescent when young: lvs. obovate to oblong, obtusely pointed, entire or finely crenulate, bright green above, finely pubescent beneath, translucently glandular-punctate, 2–4 in. long: fls. small, greenish: pods about ½ in. long, light greenish brown. April, May. Japan. Gt. 35:1232.

ALFRED REHDER.

ORNAMENTAL GARDENING, or ornamental horticulture, is that branch of horticulture which is concerned with cultivating plants of all kinds for ornament rather than for food. It includes floriculture and also the culture of trees for shade and display. (The culture of trees on a large scale for timber and for other profitable purposes aside from ornament is forestry. The culture of trees in general is arboriculture.) Ornamental gardening includes carpet-bedding and formal gardening in general, while landscape gardening is concerned with making nature-like pictures, or at least with the general plan of the place.

ORNITHÓGALUM (Greek, *bird* and *milk;* application unknown). *Liliàceæ.* This genus includes the Star of Bethlehem, a dwarf, hardy bulbons plant which bears umbels of green and white fls. in May and June. Ornithogalum is one of the largest genera in the lily family, containing about 100 species scattered over Europe, the Orient, North and South Africa. In 1873, when Baker monographed the genus (in Latin) in the Journal of the Linnean Society, he recognized 73 species altogether, but in 1897 he gives an account (in English) in Flora Capensis of an equal number from South Africa alone. Baker made 7 subgenera, based chiefly upon the color of the fls. and the shape of the cluster, though one subgenus was cut off from all the rest by having the stamens perigynous instead of hypogynous. The majority of the species seem to have more or less green in the fls. either on the face or back or both, and often the green is prettily set off by a narrow white margin. Some species have pure white fls. and a few have yellow or yellowish ones. Some of the dominant forms of flower-clusters are oblong-cylindrical, broadly triangular, subcorymbose and lanceolate. Ornithogalum is distinguished from other genera as follows: perianth persistent; tube none; segments 6, usually spreading: filaments more or less flattened and in many species unequal; alternate ones being broader at the base: ovary sessile, 3-celled; ovules many in a cell, superposed: style short or long: capsule membranous, loculicidally 3-valved: seeds globose, usually not crowded nor compressed: often the perianth segments are keeled and the green color follows the keel.

Horticulturally, Ornithogalums may be divided into hardy and tender groups, and each of these may be subdivided into dwarf and tall. The hardy kinds are considered by English amateurs amongst the choicest summer-blooming bulbs for wild gardening. With the remarkable increase of wild gardens now going on in America, arrangements should be made so that amateurs may procure these bulbs cheaply and scatter them with a free hand along woodland walks and in the grass. The common Star of Bethlehem, *O. umbellatum,* a dwarf kind, is the only Ornithogalum that is at all common in our gardens. *O. nutans* has escaped from a few old gardens but seems never to be advertised in America, and rarely even by the Dutch bulb-growers, but in England "it is a very popular species and one of the most easily managed of all the Ornithogalums. In borders amongst other named bulbs, however, it becomes a great nuisance, an accounr of the freedom with which its innumerable bulbils are formed. In a semi-wild or uncultivated spot it is a capital subject for groundwork; it requires no attention whatever, and flowers freely all through April and May."

Of the taller hardy kinds *O. latifolium* and *O. pyra-*

midale seem to be the most desirable. These are the best to place among shrubbery and leave undisturbed for years. A particularly robust clump of *O. latifolium* is recorded as bearing over a hundred spikes of flowers on stalks 3 ft. high. *O. pyramidale* is here doubtfully referred to *O. Narbonense*, but there is no doubt about the beauty of the plant which English gardeners call *O. pyramidale*. For formal beauty it is hard to excel. It sometimes makes a perfect pyramid of starry white flowers, the spike 12–18 in. long, the fls. an inch across, and a hundred or more fls. in a spike.

The tender kinds in cultivation are chiefly from the Cape of Good Hope, though *O. Arabicum* is found in the Mediterranean region. Connoisseurs are divided between *O. Arabicum* and *O. revolutum*, but the former has been more pictured and has a greater number of admirers. When well grown it is probably the showiest plant of the whole genus. *O. Arabicum* is a fickle plant. It grows to perfection in Guernsey, with stalks 3 ft. high and fls. 2 in. across, borne in free, informal clusters. The tall-spiked waving masses of white remain in good condition for some weeks. In Guernsey they are esteemed for cut-flowers. The white of the large, broad-petaled fls. is set off by a gleaming black pistil, which makes a striking and pretty feature. *O. Arabicum* is suitable for pot culture in northern conservatories, but perhaps the best way to grow it is in quantity in a frame. The bulbs have a way of remaining dormant for a season or two, a difficulty possibly to be associated with their insufficient ripening. W. Goldring writes: "To keep the pots with the bulbs in them in a greenhouse and not watered is not sufficient; they should be kept in a dry atmosphere, and if baked in the sun, so much the better. Autumn is the best time to get bulbs, and after potting they should be kept dry till spring, and with the signs of growth plenty of water should be given, and occasional weak manure water." It is suspected that there are two varieties, a shy-blooming and a free-blooming kind. This may explain some of its repntation for capriciousness. *O. thyrsoides* is easier to grow and earlier to bloom. With gentle forcing it may be had for Christmas in a moderately warm house. *O. revolutum* is very distinct by having revolute instead of spreading segments. It was cult. by a Cincinnati amateur in 1883, but to-day one may search a dozen of the largest bulb catalogues without finding it offered. *O. caudatum* is similarly rare in trade catalogues, but it is still cultivated in dwelling houses under the erroneous name of Sea Onion. The Sea Onion is *Urginea maritima*, a plant of the same general appearance but distinguishable in leaf, flower and fruit as follows: *Urginea maritima* has lvs. 2–3 in. wide: raceme 1½–2 ft long: bracts 3–4 lines long: fls. white with a brown keel: seeds crowded, disk-like. *Ornithogalum caudatum* has lvs. 1–1½ in. wide; raceme ½–1 ft. long: bracts 6–9 lines long: fls. keeled with green: seeds not crowded nor compressed.

Perhaps the best purely horticultural reviews of this group are to be found in The Garden: the tender kinds by Goldring in Gn. 49, p. 308; the hardy kinds by "D.K." in Gn. 41, p. 376.

A. *Fls. self-colored, both front and back.*

B. *Pistil prominent, shining, greenish black.*

Arábicum, Linn. Fig. 1594. Bulb ovoid, 1–1½ in. thick, proliferous: lvs. 5–8, glaucous green, 1–1½ ft. long, ¾–1 in. wide: scape 1–2 ft. long: raceme 6–12-fld., roundish or deltoid in outline, 3–5 in. long and wide: fls. self-colored, odorous; filaments lanceolate, not cuspidate, alternate ones distinctly broader, but not quadrangular on the base. Mediterranean region. B.M. 728. Gn. 49:1063 (good). B.M. 3179 and B.R. 11:906 (as *O. corymbosum*). G.C. II. 19:665. Gn. 22, p. 249; 32, p. 145; 41, p. 377; 48, p. 309.—The pistil is a beautiful and striking feature.

BB. *Pistil not a striking feature, dull, smaller.*

C. *Number of flowers in a cluster 12–30.*

thyrsoides, Jacq. Bulb globose, 1½–2 in. thick: lvs. 5–6, lanceolate, 6–12 in. long, 1–2 in. wide: scape ½–1½ ft. high: raceme 12–30-fld., dense, triangular in outline, 3–4 in. wide: fls. self-colored; filaments alternately longer and lanceolate, alternately shorter, dilated above the base and bicuspidate. S. Afr. B.M. 1164 (fls. white, with a brown eye).

Var. **aùreum**, Ait. (*O. aùreum*, Curt.), has golden yellow fls. B.M. 190 (fls. saffron).

Var. **flavéscens**, Ker., has pale yellow fls. B.R. 4:305.

CC. *Number of flowers in a cluster 50–100.*

latifòlium, Linn. Lvs. 5–6, ascending, glabrous, fleshy herbaceous, broadly lorate, 12–15 in. long, 1½–2 in. wide in cult.: filaments about equal, lanceolate. Tauria, Caucasus, Kurdistan, Arabia, Egypt. B.M. 876. B.R. 23:1978 (fls. green only at tip of keel, and borne in a perfect pyramid).

AA. *Fls. with a green face, the outer segments narrowly margined white.*

B. *Cluster inversely pyramidal in outline.*

tenuifòlium, Gnss. Bulb ovoid, 1 in. thick, simple: lvs. 5–6, narrowly linear, 5–6 in. long, 1–2 lines wide, unspotted: scape 2–3 in. long: raceme 6–10-fld., corymbose or inversely triangular in outline, 2–3 in. long and wide: pedicels ascending: fls. with outer perianth segments margined white. Mediterranean region.

BB. *Clusters quadrangular in outline.*

C. *Number of flowers 12–20.*

umbellàtum, Linn. Star of Bethlehem. Bulb subglobose, 1 in. thick, bearing numerous bulbils: lvs. 6–9, narrowly linear, 6–12 in. long, 2–4 lines wide, deeply channeled, distinctly spotted white: scape 4–6 in. long: raceme 12–20-fld., quadrangular in outline, 4–6 in. long, 6–9 in. wide: lower pedicels in fr. spreading: fls. with outer perianth segments margined white. Mediterranean region. Escaped from old gardens in U. S.

CC. *Number of flowers 3–12.*

exscàpum, Tenore. Bulb ovoid, ¾–1 in. thick, not proliferous: lvs. 5–6, narrowly linear, 4–6 in. long, 1–2 lines wide, glabrous, spotted, disappearing after the fls.: scape 1–1½ in. long: raceme 3–12-fld., quadrangular in outline, 1½ in. long, 2½–3 in. wide: lowest pedicels in fr. deflexed: bracts ¾–1 in. long, shorter than the pedicels: fls. with outer perianth segments margined white: style very short. S. Eu.

1594. Ornithogalum Arabicum (×½).

AAA. *Flowers more or less white-faced, but keeled with green on the back.*

B. *Blossoms nodding.*

nùtans, Linn. Bulb ovoid, 1–1½ in. thick, producing offsets freely: lvs. pale green, 1–1½ ft. long, 3–6 lines wide, disappearing after the fls.: scape 8–12 in. long: raceme 3–12-fld., oblong-cylindrical in outline: pedicels

shorter than the bracts: fls. green, margined white on back, the lower ones nodding. Eu., Asia Minor. B.M. 269. Gn. 32:621 & p. 77; 41, p. 376.—Rarely escaped in U. S.

BB. *Blossoms erect or ascending.*

C. *Width of leaves 3–6 lines.*

Narbonénse, Linn. Bulb ovoid, 9–15 lines thick: lvs. strap-shaped, 1–1½ ft. long, 3–6 lines wide, glabrous, glaucous green, scarcely disappearing before the end of flowering: scape 1–1½ ft. long: raceme 20–50-fld., oblong-cylindrical, 4–8 in. long, 1½–2 in. wide: lowest pedicels 9–15 lines long: fls. whitish, keeled green on the back; filaments lanceolate at base, not squared. S. Eu. B.M. 2510 (striped green back and front).—*O. pyramidàle,* Linn., is considered by Baker to be a robust, large-fld. garden form, but it is said to grow wild in Spain and Portugal and may be a distinct species. Fls. white, with a green stripe on back. Gn. 41:854.

CC. *Width of leaves 9–18 lines.*

D. *Filaments alternately linear and lanceolate.*

longebracteàtum, Jacq. Lvs. rather fleshy, glabrous, lanceolate, 1½–2 ft. long, ¾–1½ in. wide, persistent until after flowering: scape 1½–2 ft. long: raceme dense, 30–60-fld., oblong-cylindrical, 6–9 in. long, 15–18 lines wide: lowest pedicels 9–12 lines long: fls. whitish, keeled green on the back: bracts 9–15 lines long; filaments alternately linear and lanceolate at the base. S. Afr.—Baker says the bulb is 3–4 in. thick.

DD. *Filaments alternately lanceolate and quadrate at the base.*

caudàtum, Ait. Lvs. lorate, 1½–2 ft. long, 1–1½ in. wide: scape 1½–3 ft. long: raceme dense, ½–1 ft. long: fls. banded green on face, and keeled green: bracts 6–9 lines long. S. Afr. B.M. 805. Window plant.

AAAA. *Fls. white, with a brown or greenish yellow eye: perianth segments revolute.*

revolùtum, Jacq. Lvs. lanceolate, 6–9 in. long, 6–9 lines wide: fls. not keeled with green, many in a subcorymbose cluster; style very short and stout. S. Afr. B.M. 653. B.R. 4:315.

W. M.

ÓROBUS is considered a subgenus of Lathyrus, but for *O. formosus,* see *Pisum,* and for *O. lathyroides,* see *Vicia.* Since Lathyrus was written for this work, the names of 3 other species of Orobus have been prominently mentioned in this country: *O. aurántius*=*Vicia aurántia; O. flaccidus*=*Lathyrus vernus,* var. *flaccidus,* Ser., which is distinguished from the type by its very narrow, flaccid lvs.; and *O. Pannonicus,* a puzzling name, which is discussed in the next paragraph.

Orobus Pannonicus, Jacq., is by Index Kewensis referred to *Lathyrus Pannonicus,* Garcke, but older authorities, as DeCandolle and Koch, refer it to *Lathyrus albus,* Linn. f. *L. albus* differs from other species as follows: root of clustered, club-shaped fibers: stem angled, unbranched, narrowly winged above: lfts. 2–3 pairs, linear-lanceolate and linear: style linear. Normally it has white or yellowish fls., with the standard often flushed rose color on the back; but var. *versicolor,* Koch, has a purple standard, with yellow wings and keel. This is B.M. 675 (as *O. varius*) and probably the form in cult.

ORÓNTIUM (one of many names arbitrarily applied by Linnæus; he probably had in mind some water plant growing in the Syrian river Orontes). *Aràceæ.* Golden Club. *Orontium aquaticum,* or Golden Club, is a hardy, native, aquatic plant, which bears in early spring yellow "clubs" on white stalks. The "club" is a cylindrical spadix 1–2 in. long. The lvs. are ascending or floating, according to the depth of the water. They are oblong-elliptic, with a blade 5–12 in. long, and no distinct midrib, but numerous parallel veins. The foliage is handsome, dark velvety green above, silvery below. The plant is very strong and deeply rooted, growing in water 10–18 in. deep. On account of its firm hold on the soil it may be planted in swifter water than most aquatics. It has the fault of being difficult to eradicate when firmly established.

Orontium is a genus of one species, which is found in swamps and pools from Mass. to Fla., mostly near the seacoast, but extending as far inland as central Pa. and La. Spathe usually soon deciduous: fls. hermaphrodite, covering the whole spadix; sepals scale-like, imbricated upon the ovary, usually 4 in the upper and 6 in the lower fls.; ovary 1-celled; ovule solitary, semi-anatropous: fr. a green utricle.

aquáticum, Linn. Golden Club. Blade of lvs. 5–12 x 2–5 in.: stalk 4–20 in. long: scape ½–2 ft. long. B.B. 1:364. L.B.C. 5:402. R.H. 1888:85. Gn. 27, p. 213.

F. W. Barclay.

ORÓXYLON (Greek, *a mountain tree;* nevertheless it grows anywhere from sea-level to an altitude of 3,000 ft.). Also written *Oroxylum. Bignoniàceæ.* A genus of one species, an Indian tree, which, as Franceschi says, is "remarkable for the large size and striking form of its leaves, almost black flowers, and long, sword-shaped pods." This tree is cult. outdoors in S. Calif. and under glass in Europe. It attains 25–40 ft. in India, has lvs. 2–4 ft. across, which are shining and twice or thrice ternately pinnate; lfts. 5 x 3–4 in.: raceme 10 in. long: fls. fleshy, 2½ in. long, 2–3½ in. across, bell-shaped, and white or purplish according to the Flora of British India.

This tree has no near ally of garden value. It might be roughly compared to a Catalpa for its long pods and winged seeds, and for its much-cut foliage to *Jacaranda ovalifolia,* which is one of the most striking and elegant trees cultivated in subtropical countries. Generic characters are: calyx large, leathery, truncate or obscurely toothed: corolla-lobes 5, subequal, round, crisped, toothed: stamens 5: capsule septicidally 2-valved: seeds thinly discoid, with a broad, transparent wing.

Índicum, Vent. Lvs. opposite; lfts. ovate, entire: peduncle 1 ft. long: capsule 1–3 ft. long, 2–3 in. wide, hardly 4 lines thick. India, Ceylon, Cochin China, Malaya.

ORPINE or **STONE CROP.** See *Sedum,* particularly *S. Telephium.*

ORRIS-ROOT or **IRIS-ROOT.** See *Iris Florentina* and *Perfumery Gardening.*

ORTHOCÁRPUS (Greek, *straight fruit,* which distinguishes this genus from Melampyrum). *Scrophulariàceæ. O. purpuráscens,* Benth., is a plant something like the Painted Cup (Castilleia). It is a Californian annual, growing a foot or less high, with yellow, crimson-tipped fls. and gaudy bracts. Gray says it is "common along the hills and mountains of the coast, from San Diego to Humboldt Co., so abundant as to give the ground a purple hue for miles in some places; occasionally, with duller or only pallid color, in salt marshes. The reddish, soft and copious beard of the narrow and hooked upper lip which marks this species is composed of many- and close-jointed hairs." This plant was offered in 1891 by Orcutt. For fuller description see Gray's Syn. Flora of N. Amer. In Orthocarpus the calyx is 4-cut; in Castilleia many-cut.

ORTHROSÁNTHUS (Greek, *morning flower;* because the fls. open in the morning and fade before noon). *Iridàceæ. O. multiflorus* is a charming plant something like our blue-eyed grass or Sisyrinchium. It has a tuft of grassy foliage a foot or two high, and sky-blue, 6-parted fls. an inch or more across, which open one after another for a week or so. Horticulturally it is classed among tender bulbs, though its rootstock is a short, thick rhizome. This choice plant comes from Australia, which, unlike the Cape of Good Hope, is very poor in showy bulbous plants of the iris, lily and amaryllis families.

Orthrosanthus is a genus of 7 species, 2 from tropical America and 5 from Australia. Lvs. firm, linear, equitant: clusters many-fld., paniculed: fls. pale blue; pedicels so short that the capsule is not protruded from the spathe; perianth-tube very short or none; segments oblong, nearly equal, spreading; filaments free or connate only at the base: ovary 3-celled; ovules many,

superposed; style-branches alternating with the anthers: seeds minute, very near Sisyrinchium, which is a more variable genus, and has longer pedicels. See Baker's Handbook of the Iridæ (1892).

There seems to be no recorded American experience with *O. multiflorus*. Krelage lists it among bulbs suitable for frame culture. Nicholson says it thrives and does best when planted in the border of a cold conservatory, and adds "if, however, it is necessary to grow them in pots, use turfy loam and leaf-mold, and insure sufficient drainage."

multiflorus, Sweet (*Libértia azúrea*, Hort.). Lvs. a dozen or more, 1–1½ ft. long, ⅛ to ¼ of an inch wide: panicle 4–6 in. long: capsule obtuse. Southern and western Australia. L.B.C. 15:1474. B.R. 13:1090 (as *Sisyrinchium cyaneum*). W. M.

ORŸZA (derived from the Arabic name, Eruz) *Gramíneæ*. Six species of the tropics, including *O. sativa*, Linn., the well-known rice of commerce. This is a native of the Old World tropics, and is naturalized in Brazil; cultivated extensively in China and India and more recently in the coast region of our southern states. A marsh plant, with flowers in panicles; spikelets 1-fld.; empty glumes 2, small; fl.-glume and palet about equal, laterally compressed, keeled, the former usually more or less awned. Contrary to the usual supposition, rice paper is not made from rice, but from Paper Mulberry or Bamboo. A. S. Hitchcock.

ORYZÓPSIS (Greek, *rice-like*; from a fancied resemblance to that grain). *Gramíneæ*. Mountain Rice. Contains about 24 species of temperate regions. Mostly tufted perennials, with narrow panicles of rather large greenish 1-fld. spikelets. Empty glumes thin, nerved, nearly equal: fl.-glume coriaceous, becoming involute, provided at base with a short callus, and at apex with a simple untwisted deciduous awn. Three of our native species are offered by dealers in wild plants.

melanocárpa, Muhl. Distinguished by its leafy culm, the lvs. being broad and flat: panicle simple or compound; fl.-glume blackish: awn about 1 in. long. Rocky woods, New Eng. to Mo.—Blooms late in summer.

asperifólia, Michx. This and the next have tufted, naked culms, with flat, concave or involute lvs.: culms 9–18 in. high, bearing sheaths with rudimentary blades: lvs. rough-edged, evergreen: awn ½ in. long. Northern states to Colorado.—Blooms early in spring.

Canadénsis, Torr. Culm 6–15 in.: lowest sheaths leaf-bearing: lvs. involute, thread-shaped: awn very short, deciduous or wanting. Me. to Minn., on rocky hills; rare. A. S. Hitchcock.

OSAGE ORANGE. See *Toxylon*.

OSIERS are willows used for baskets and willow-ware in general. Some dogwoods are also called Osiers. The various kinds are described under Salix and Cornus. Osier culture is generally considered as belonging to sylviculture rather than to horticulture, and is therefore not treated here, but the interested reader should procure "Osier Culture," by John M. Simpson, a pamphlet of 27 pages, issued in 1898 as Bulletin 19 of the Div. of Forestry, U. S. Dept. of Agriculture.

OSMÁNTHUS (*fragrant flower*). *Oleàceæ*. The cultivated members of this genus are usually known as Oleas, but Osmanthus is distinguished from Olea by its imbricate rather than valvate obtuse corolla-lobes: fls. fascicled or in short, perfect or imperfect racemes: lvs. generally opposite, entire or serrate, thickish: evergreen trees or shrubs, of 7 or 8 species in eastern Asia, Pacific islands, and one in North America. *O. fragrans* is the only common species in cult., and this is a greenhouse plant in the North, being grown for its very fragrant fls. It is of the easiest cultnre in an intermediate temperature. It is almost a continuous bloomer, although ordinarily it should be rested in late winter or summer in order to ripen the wood for fall and winter bloom. Be careful not to overpot, and keep the plant free from mealy bug. In the South and in California, it thrives when planted out in a place shaded from the midday sun.

A. *Lvs. small-toothed or entire.*

fràgrans, Lour. (*Olea frágrans*, Thunb.). Fig. 1595. Small tree or shrub, usually cult. as a pot-plant: lvs. oval to oblong and lanceolate, finely sharp-toothed (said to be entire in the wild plant), thick, lighter colored and veiny beneath: fls. small, white, the corolla divided nearly to the base, in clusters in the upper axils, very fragrant: fr. not produced on the cult. plant, but on the wild plant said to be ellipsoid and ¾ x ½ in. India, China, Japan. B.M. 1552. L.B.C. 18:1786.

1595. Osmanthus fragrans (×⅓).
Olea fragrans of gardens.

Americànus, Benth. & Hook. Devil-wood. Florida Olea. Glabrous small tree or tall shrub, with whitish bark: lvs. thick, evergreen, lance-oblong, with a short petiole, entire, shining above: fls. polygamous or dicœcious, dull white, in panicles which are shorter than the lvs., fragrant: fr. a small dark purple drupe. Blooms in spring. N. Car., southb. S.S. 6:279, 280.—This plant is in cult. in choice collections south, but it is not now advertised.

AA. *Lvs. usually spiny-toothed and holly-like.*

Aquifólium, Sieb. Small, evergreen tree, with elliptic or oblong-ovate, stiff spiny-toothed, shining lvs., 3–4 in. long: fls. white, in short axillary clusters appearing in autumn, very fragrant, larger than in *O. fragrans*. Japan. G.C. II. 6:689. Very variable. Var. **ilicifólius,** Hort. (*Olea ilicifólia*, Hassk.), is a compact dense shrub, with smaller lvs. There are variegated-leaved forms (as *O. Aquifolium*, vars. *aureum* and *argenteum*). Var. **myrtifólius,** Hort., has compact habit, with rigid, spineless lvs. *Osmanthus Aquifolium* is hardy with some protection as far north as Baltimore and Philadelphia. Variegated forms are sometimes grafted on privet, but they lack in constitution.

O. latifolia and *O. ligustrifolia* of the trade are probably Phillyreas. *O. buxifolia*, Hort., is probably Olea Capensis, Linn., a shrub from S. Africa. L. H. B.

OSMORHÌZA (Greek; referring to the sweet, aromatic, edible roots). *Umbellíferæ*. A small genus of perennial herbs, 1–3 ft. high, with ternately decompound foliage and white fls. in few-rayed umbels. They are sometimes called Sweet Cicely, but the true Sweet Cicely is *Myrrhis odorata*, a closely allied European plant, the lvs. of which have the scent of anise seed and are used in flavoring. Two western species were once advertised in the eastern states, and 2 eastern species are rarely offered. F. W. Barclay, who has charge of a very large collection of native plants, writes that the eastern species require a loose, rich, rather moist loam. He adds that they are usually to be found in shady places, but where soil conditions are suitable they do well in the sun. Wilfred Brotherton remarks that their foliage turns a handsome purple in autumn.

Generic characters: Calyx-teeth obsolete: fr. linear,

glabrous or bristly; carpel slightly flattened dorsally or not at all; styles long or short; seed-face from slightly concave to deeply sulcate. Coulter and Rose, Monograph of North American Umbelliferæ, 1900. The generic name is also spelled *Osmorrhiza*.

A. *Fr. with prominent caudate attenuation (2–4 lines long) at base, very bristly.*

B. *Style a line or more long.*

longistylis, DC. Stout, glabrous or slightly pubescent. Canada to Va. and west to Dakota. B.B. 2:530.—Roots with a stronger smell and taste of anise than *O. brevistylis*. Brotherton says it is a much prettier plant than the next, with larger umbels.

BB. *Style half a line or less long.*

C. *Lflts. 2–3 in. long: rays stout, 1–2 in. long.*

brevistylis, DC. Rather stout, villous-pubescent: lvs. 2–3-ternate: style and stylopodium half a line long. Canada to N. C. B.B. 2:530.

CC. *Lflts. ½–2 in. long: rays slender, 2–4 in. long.*

nùda, Torr. Rather slender, somewhat pubescent or glabrous: lvs. twice ternate: style and stylopodium ¼ line long. Mts., Calif.

AA. *Fr. without caudate attenuation at base.*

occidentàlis, Torr. (*Myrrhis occidentàlis*, Benth. & Hook.). Rather stout, puberulent or pubescent: lvs. 2–3-ternate; lflts. 1½–4 in. long: umbel 5–12-rayed: rays 1–5 in. long: stylopodium and style ½–1 line long. Calif. to Wash., east to Montana. W. M.

OSMÚNDA (from *Osmunder*, a name of a Saxon god). *Osmundàceæ*. A small genus of showy native ferns, with rather coarse foliage, but highly ornamental from their clustered habit. The sporangia are formed in panicles borne on the veins of reduced lvs., provided with a rudimentary transverse ring and opening vertically.

A. *Lvs. fully bipinnate.*

regàlis, Linn. Royal Fern. Growing in clumps 2–5 ft. high, some of the leaves bearing panicles at their summits; pinnæ 1–2 in. long, rounded at the base and usually blunt. Well adapted for open, moist places.

1596. Royal Fern—Osmunda cinnamomea.

Eu., N. Amer. and Japan.—Commonly called Flowering Fern or King-fern. *O. Japonica*, Thunb., is a form with the sporophylls forming distinct leaves and soon withering away; various crested forms appear in cultivation.

AA. *Lvs. bipinnatifid only.*

cinnamòmea, Linn. Cinnamon Fern. Fig. 1596. Plate XI. Growing in clusters 2–4 ft. high or even more, the sporophylls appearing earliest, at first green, but becoming pale, long and narrow, cinnamon-colored at maturity of the spores, the lvs. growing about a crown from a large, mostly vertical rootstock. N. Amer. —Very handsome for decorative purposes, especially for low grounds.

Claytoniàna, Linn. Growing in crowns, with the sporangia confined to a few (4–10) of the central pinnæ of the leaf, and of a dark brown color. Similar to the last, but lacking the little tuft of wool in the axils of the pinnæ which characterizes the Cinnamon Fern. N. Amer; said also to grow in India.

L. M. Underwood.

Osmundas are strong-growing ferns of vigorous constitution, and well adapted for general culture in any fertile soil which is not over dry. They are deep-rooted ferns and, therefore, require considerable depth of soil. All the species do well in full sunlight, but the most satisfactory position for all the species would be a deeply dug, thoroughly enriched border lying north of a wall. *O. regalis* reaches perfection only in rich, wet swamps in full sunlight or thin shade, where it may attain a height of 8 ft. *O. Claytoniana* prefers rich, peaty soil in moist but not wet, open or partially shaded positions. It may attain a height of 6 ft. *O. cinnamomea* is naturally a fern of the swamp, though not in such wet positions as *O. regalis*. It grows most luxuriantly in partial shade. In a wild state it occasionally attains a height of 6 ft.

F. W. Barclay.

OSTEOMÈLES (Greek, *stone apple* or *stone fruit*). *Rosàceæ*. The plant which bears the uncomfortable name of *Osteomeles anthyllidifolia* is a white-fld., red-fruited bush, ranging from China through the Pacific islands as far south as Pitcairn's island. It has pinnate foliage, silvery beneath, each leaf 2–4 in. long and composed of about 25 lflts. The specific name of the plant records its resemblance in foliage to *Anthyllis Barba-Jovis*, a plant with pea-like fls., known as Jupiter's Beard, which is considerably used for seaside planting in frostless countries. Botanically Osteomeles is closest to our shad bush (Amelanchier), but inferior in hardiness and in beauty of fls. All the other species of Osteomeles (about 7) are natives of the Andes, and have simple lvs. The silvery nature of *O. anthyllidifolia* varies considerably in the wild, and glabrous specimens have been collected.

Generic characters: trees and shrubs: lvs. alternate, stalked, leathery, evergreen, entire or serrate: fls. white, few or numerous, in flattish clusters: calyx-tube bell- or top-shaped, adnate to the carpels; lobes 5, persistent; petals 5, oblong; stamens 10 or more, inserted on the throat of the calyx; carpels 5, more or less grown together and to the calyx: drupes 5-stoned.

anthyllidifòlia, Lindl. Evergreen bush, 5–6 ft. high, much branched: bark brownish black: lvs. spreading and recurved; lflts. more or less in pairs, yellowish green: fls. about ⅔ in. across, a dozen or so in a cluster. B.M. 7354. W. M.

OSTEOSPÉRMUM moniliferum is a shrubby yellow-fld. composite, growing 2–4 ft. high, which was offered in 1891 by Reasoner Bros., Oneco, Fla. It has dropped out of cult. It is fully described in Flora Capensis 3:433, where the entire genus of 38 species is monographed.

OSTRÓWSKIA (after N. ab Ostrowsky, Russian patron of science). *Campanulàceæ*. The Giant Bell-flower, *O. magnifica*, ranks among the two dozen most interesting "hardy perennials" introduced during the last two decades of the nineteenth century. Each stem grows 4 or 5 ft. high, is branched only at the top, and bears 3–6 bell-shaped, pale lilac fls. 4–6 in. across and 4 in. deep. A healthy clump may throw up as many as 6–10 stems. Before the discovery of this plant, *Platycodon grandiflorum* was generally considered the showiest of all the large bell-flowers, but J. N. Gerard declares that the Platycodon is very commonplace beside Ostrowskya. In the colored plates the flowers have a rather washed-out appearance, except in "Garden," which shows pinkish tints. Gerard describes the color as a very light lavender or mauve, almost white, with deeper veinings.

Osmunda cinnamomea, the cinnamon fern, in its native haunts

A dark blue variety was thought to exist, but unfortunately nothing of the kind has been seen in cultivation. Altogether it is a very singular plant, with its great fleshy roots, sometimes 2 ft. long, its whorled lvs., and the conspicuous pores of the capsule, which are twice as numerous as the sepals—a generic character. Unlike Platycodon, its lvs. are membranous and light green. It is the only species in the genus. As a genus Ostrowskya is close to Campanula, being distinguished by the whorled lvs. and the floral parts numerically greater.

The Giant Harebell needs a deeply worked, perfectly drained, sandy soil. Soon after flowering the plants go to rest and nothing is left of them above ground. Their place should be carefully marked to protect the brittle roots from careless digging. Our dry summers and autumns seem to suit the plants well, but frequently in a moist October growth starts and this seriously weakens the old plants. When only a few plants are grown, a tight board covering will be found convenient for keeping the roots dry and dormant. For winter protection it is advisable to give a liberal coveriug of litter. Excessive moisture will destroy the crown. Flowering specimens can hardly be expected within 4 years from seed, and seeds are slow to germinate unless fresh. Nurserymen now propagate the plant by cuttings of the young growths taken with a heel in spring; amateurs by root-cuttings.

magnifica, Regel. GIANT BELL-FLOWER. Tall, strict, glabrous herb, with tuberous roots: lvs. in distant whorls of 4 or 5, ovate, toothed, short-stalked, 4–6 in. long: calyx-lobes 2 in. long, spreading or recurved: floral parts 5–9, usually 7: style large, thick, yellow. Eastern Bokhara, at 7,000 ft. Gn. 34:681; 52, p. 481. B.M. 7472. G.F. 6:276. A.F. 4:331. V. 11:305. G.M. 31:459, 461. R.H. 1893:472 and p. 473; 1888, p. 344. I.H. 35:71. G.C. III. 4:65. S.H. 1:437.

J. B. KELLER and W. M.

OSTRYA (ancient name). *Cupuliferæ. Ostrya Virginica,* commouly known in America as Hop Hornbeam, Ironwood or Leverwood, is a small- to medium-sized tree, with birch-like foliage, slender yellow male catkins borne in spring, and female catkins which look like clusters of hops, and ripen in July and August. In the eastern states the Hop Hornbeam usually grows about 15 to 18 ft. high, but in the Middle West it grows much higher, sometimes attaining 50 ft. The bark is beautifully furrowed. The species has a wide range, but is not common. *O. carpinifolia,* Scop., and *O. Japonica,* Sarg., have proved hardy at the Arnold Arboretum.

Ostrya is a genus of 4 species—the following, one in southwesteru U. S., one in Eu. and Asia and one in Japan. Catkins borne with the lvs. or before; males drooping, sessile at the ends of branchlets of the previous year, their fls. solitary in the axil of each bract; females terminal, solitary, erect, their fls. 2 to each bract, enclosed by a bractlet, which in fruit enlarges into a closed membranous bladder: male fls. without bractlets; stigmas 2: nut compressed, sessile in the base of the bladder-like sac.

Virginica, Willd. Fig. 1597. Lvs. ovate or oblong-ovate, acuminate, doubly serrate: bladders 6–8 lines long, 4–5 lines wide in fruit; female catkins 1½–2½ in. long. Dry woods, Cape Breton to Minn., south to Fla. and Tex. S.S. 9:445. B.B. 1:507. Gn. 24, pp. 230, 231.

OSWEGO TEA. *Monarda didyma.*

OTHÈRA Japónica, imported by Berckmans, Augusta, Ga., is an evergreen shrub, with obovate or oblong-obovate glabrous lvs., entire or nearly so, and 2–3 in. long. There can be but little doubt that it is a species of Ilex, but the shape of the lvs. does not agree exactly with the figure given by Thunberg of his *O. Japonica,* which was subsequently referred to Ilex by Sprengel under the name *I. Othera.* In none of the more recent publications on the Japanese flora, however, is either name mentioned, and it is likewise omitted in the monograph of Ilex by Maximowicz. As the genus Othera has no botanical standing it is perhaps the best to use *Ilex Othera* as a provisional name for the cultivated plant until it has borne fls. and fr., and thus enabled us to determine its exact botanical position. In foliage it resembles very much *I. integra,* and it may probably prove to be this species when the fruits are known. The *Othera Japonica* of Thunberg as figured in his Icones Plantarum Japonicarum, pl. 13, is much like *I. rotunda,* and may represent a plant of this species with staminate fls. The hardiness of the cultivated *Ilex Othera* is probably the same as that of *I. latifolia* and *integra,* and also its cultivation and propagation. See *Ovixa.*

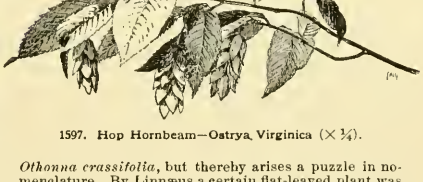
ALFRED REHDER.

Othera Japonica, a very beautiful ornamental evergreen shrub or small tree, is well established in several Florida gardens. In the late E. H. Hart's garden, at Federal Point, Fla., there is a small, bushy, dense tree, about 22 feet high, which has flowered and fruited abundantly. Two plants in my own garden, one on high pine land, the other in richer soil near the lake, have done exceedingly well, though the one in moist ground is by far the larger and very dense. They were planted out in the fall of 1896, and the most vigorous one is now 7 feet high, and as much in diameter, provided with branches from the ground. The plant resembles *Ilex integra,* but is different in habit and growth. Whatever its correct botanical name may be, it is a very beautiful plant for the extreme South, and it well responds to good cultivation and fertilizing.

H. NEHRLING.

OTHÒNNA (ancient Greek name, of no particular application here). *Compósitæ.* About 80 South African herbs and shrubs, of which one (Fig. 1598) is in general cultivation as a window-garden plant. The heads are usually yellow, with fertile rays and sterile tubular disk florets: torus convex or somewhat conical, usually honeycombed: scales of involucre in one series, more or less united to the base, valvate: style of disk fls. not divided: akenes oval, with bristle-like pappus in many rows or series. Only one species of Othonna appears to be in general cultivation, and this has no established vernacular name in this country, although it is sometimes dubbed "Little Pickles" because of its cylindrical, pulpy leaves.

The plant shown in Fig. 1598 is commonly known as



1597. Hop Hornbeam—Ostrya Virginica (× ¼).

Othonna crassifolia, but thereby arises a puzzle in nomenclature. By Linnæus a certaiu flat-leaved plant was called *Othonna crassifolia.* Subsequently some of the species of Othonna were separated by Jaubert & Spach into a distinct genus, Othonnopsis, distinguished by involucral scales distinct and style of the disk florets 2-parted. One of the plants relegated to this new genus was *Othonna cheirifolia,* Linn., which then became *Othonnopsis cheirifolia,* Jaub. & Spach. Bentham & Hooker consider Linnæus' *Othonna crassifolia* to be a horticultural form of *Othonnopsis cheirifolia.* It was therefore a natural sequence to say that the *Othonna crassifolia* of horticulturists is properly *Othonnopsis cheirifolia,* a statement which the writer made in the revision of Gray's "Field, Forest and Garden Botany." It turns out, however, that the *Othonna crassifolia* of horticulturists is not the *Othonna crassifolia* of Linnæus (if he has been correctly reported). The former plant is a true Othonna. It is the *Othonna crassifolia* of Harvey; but since this name *crassifolia* was used by Linnæus, it cannot be used again in the same genus, and Harvey's plant must take some other name. In fact, before Harvey's time, the name *Othonna crassifolia* was used by Meyer for still another species. The *O.*

crassifolia of Harvey was once described as *O. filicaulis*, but this name also has been previously used in the genus. It seems, therefore, as if a new name must be

1598. Othonna Capensis, known to gardeners as O. crassifolia.
A yellow-flowered trailing plant with succulent leaves.

given to the *O. crassifolia* of Harvey and of the horticulturists, and this is done below. What, now, is Linnæus' *Othonna crassifolia?* As early as 1771, this plant was figured in color by Philip Miller as the "*Othonna foliis lanceolatis integerrimis*" of Linnæus' Hortus Cliffortianus. It was figured again by Edwards in 1818 (B.R. 4:266). It is an upright or ascending undershrub, with flat leaves reminding one of leaves of the stock. It is described in the European books, but is probably not in commercial cultivation. It is native to the north of Africa. A reproduction of part of Philip Miller's picture of the plant, reduced in size, is shown in Fig. 1599.

Capénsis (*Othónna crassifólia*, Harv., not Linn., nor Meyer. *Othonnópsis cheirifólia*, Bailey in "Field, Forest, and Garden Botany," not Jaub. & Spach). Fig. 1598. Perennial, becoming shrubby at base in its native country, glabrous, with slender trailing or drooping stems: lvs. 1 in. or less long, fleshy and cylindrical-obovoid, sharp-pointed, either scattered or in clusters: pedicels 2–6 in. long, ascending, slender: heads nearly or quite ½ in. across when well grown, the narrow, bright yellow rays wide-spreading. S. Africa.—An excellent plant for hanging baskets, for it withstands extremes of moisture and temperature. It is readily propagated by planting pieces of the stems. It blooms in nearly all seasons. Fls. open only in sun. L. H. B.

OURÍSIA (Gov. Ouris, of the Falkland islands). *Scrophulariàceæ*. *O. coccínea* is a choice alpine of tufted habit, heart-shaped lvs., and scarlet, narrowly funnel-shaped fls. 1–1½ in. long. The general appearance of the inflorescence is distinct. The fls. are borne in opposite pairs to the number of 12 on a scape a foot or more high. Each flower points at a sharp downward angle from its slender red fl.-stalk, which is as long as the flower. The fls. are 2-lipped, 5-lobed and bulged at the very base. This rare and charming plant is cultivated in America, but not advertised at present. The secret of its culture is a stiff soil combined with deep shade. (See, also, *Alpine Gardens.*)

Botanically, Ourisia is allied to the foxglove, to which it has no casual resemblance. It is a genus of 23 species, mostly natives of the Chilean and Peruvian Andes. Herbs, rarely somewhat woody at the base, usually dwarf, decumbent or creeping a short distance, glabrous or sparsely hairy: fls. either axillary and solitary, or in a raceme at the apex of a scape, usually scarlet- or rose-colored; corolla-tube cylindrical or slightly bell-shaped at the throat, lobes nearly equal: stamens 4, didynamous: style entire.

coccínea, Pers. Hardy herbaceous perennial, sparsely hairy: lvs. mostly radical, long-stalked, heart-shaped, unequally lobed and crenate: scape furnished with 1- or 2-stalked lvs. at the base, and pairs of toothed bracts, from which the pedicels arise: calyx-lobes 5, short, spreading. Chile. B.M. 5335.

J. B. Keller and W. M.

OUVIRÁNDRA (Madagascar name meaning *water yam*, referring to the edible tubers). *Naiadàceæ*. The Lace-leaf or Lattice-leaf plant, *O. fenestrális*, is one of the most distinct and interesting plants in the vegetable kingdom. It grows in Madagascar, its skeletonized leaves floating just under the surface of the water. The lvs. are merely a tracery of nerves and cross-veins, but despite their lace-like delicacy they can be handled with considerable roughness. The plant is cultivated in all the finest collections of tender aquatics. The lvs. are oblong in shape, and in fine specimens 6–18 in. long and 2–4 in. broad. See Fig. 1600.

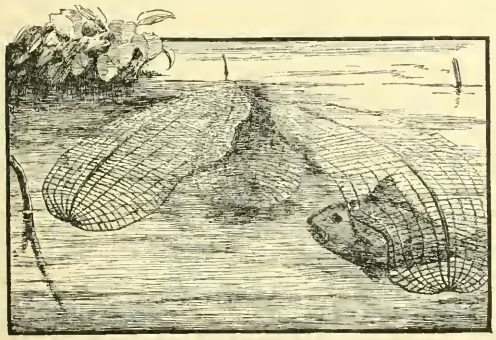
The genus and even the family of this plant is a subject of much debate. If it were not for the skeletonized foliage the plant would be referred by all to Aponogeton. However, the venation of the Lace-leaf plant is exactly that of Aponogeton, and now and then a leaf occurs in which the spaces between the veins are partly or wholly filled with green matter. Edgeworth declared that if Ouvirandra were kept distinct then 4 species of Aponogeton must go with it. *O. fenestralis* is all but unique. There is another species with skeletonized leaves (*O. Bernieriana*), but the open spaces are smaller and the plant is less desirable for cult. The prevailing tendency of the day is to refer both these plants to Aponogeton.

The Lace-leaf plant can be grown in a tub in a warm greenhouse. For some unknown reason the plant seems rarely to succeed in a jar or glass aquarium. In Mada-

1599. Othonnopsis cheirifolia.
A flat-leaved plant which has been confused with *Othonna Capensis*. For comparison with Fig. 1598.

Oxalis cernua (O. lutea), the "Bermuda buttercup" in artistic presentation

gascar, according to the Botanical Magazine, the plant grows in running water. Some cultivators think that the water must be changed every day, but this is not necessary. If confervæ appear, introduce a few tadpoles and snails; these will devour the green scum, and



1600. Lace-leaf plant — Ouvirandra fenestralis.

help to keep the plant in good health by furnishing oxygen. (See *Aquarium*.) The plant should be potted, and plunged not more than 18 inches below the surface of the water. For potting soil use a rich compost, such as is recommended for Nymphæas. The water should be kept clean and sweet, and a temperature of 65° to 75° provided. Avoid direct sunlight.

In Madagascar the streams often dry up, and the tubers carry the plant over the dry season. In imitation of nature some cultivators take the tubers out of the soil, and leave them on a shelf in a hothouse during the month of February. It is doubtful whether this is necessary. Potting should be done while the plant is in active growth, not dormant. Prop. by division.

fenestràlis, Poir. (*Aponogèton fenestràle*, Hook.). Fig. 1600. The fls. are small, and consist of 6 stamens, 3 pistils and 2 white petal-like bodies. The fls. are numerous, and borne in 2 spikes, each about 2 in. long, which are united at the base, and borne on the top of a scape a foot or so long. A.F. 7:67. A.G. 15:169. B.M. 4894. G.M. 38:830. Gn. 30, pp. 344, 345. Mn. 6, p. 231. F.S. 11:1107. I.H. 8:300.

O. Bernieriàna, Decne., differs in having smaller open spaces in the lvs., and pinkish 4-parted spikes.

WM. TRICKER and W. M.

ÓXALIS (*sharp*; referring to the usual acidity of the foliage). *Geraniàceæ*, sometimes treated as a family, *Oxalidàceæ*. Over 200 species, mostly of South Africa and tropical and subtropical America. A few are weeds or woodland plants through the northern countries of both hemispheres. Mostly bulbous or tuberous herbs, with clover-like lvs., cultivated in borders and rockeries or especially as hanging-basket or window plants for their flowers; a few used in salads, and several of the South American species grown for their edible roots or tubers. The fls. usually close at night and in cloudy weather, and the leaves "sleep" at night (Fig. 1601).

O. Acetosella produces, in addition to the showy flowers, others, concealed by the leaves, which are fertilized in the bud, like those of our native blue violets. The bulbous and tuberous species commonly consist of three otherwise similar forms, in the flowers of which the styles are respectively longer than, intermediate between, and shorter than the two sets of stamens; but the native *O. violacea* produces only the first and last of these three forms of flowers, which are designated as long-styled, mid-styled and short-styled. Several species, often treated as belonging to a separate genus, Biophytum, possess pinnate sensitive lvs.

Prop. by division of the compound bulbs or separation of the young bulbs produced at the ends of underground roots by some species, or division of the clumps of those which are tuberous, the fibrous-rooted caulescent species prop. by cuttings or division. Nearly all may be grown from seed, but this process is slower, and some rarely seed in cultivation.

Planted in rich, well-drained sandy loam in spring, they bloom continuously through the season, and are lifted for winter blooming; sometimes dried off in spring, and started into growth in autumn for indoor baskets, etc. The caulescent species are kept in continuous growth like Pelargoniums, usually in the temperate house.

The classical works on Oxalis are Jacquin's "Oxalis, Monographia, iconibus illustrata" (1794), with exquisite plates; and Zuccarini's "Monographie der Amerikanischen Oxalis-Arten," and "Nachtrag zu der Monographie der Amerikanischen Oxalis-Arten" (1825–1831). The 69 Chilean species are reviewed by Karl Reiche in Engler's Bot. Jahrb. 18:259–306 (1894).

WM. TRELEASE.

None of the cultivated kinds are hardy, at least in the North. The bulbous or tuberous kinds grown in greenhouses make handsome pot-plants for autumn and winter decoration. They are also favorite house plants, and one frequently sees them displayed as hanging plants. They are easily grown, clean, healthy, and continue a long time in bloom. The roots are started in August or September, and commence growth quickly. Good rich soil is recommended. The crowns should be kept near the surface, and deep pots used, as the plants are liable to lift themselves out. Abundance of water will be required during the growing season, and a little liquid stimulant will help them when in bloom. When going to rest, less water will be required, until finally the pots may be laid on their sides until another season.

T. D. HATFIELD.

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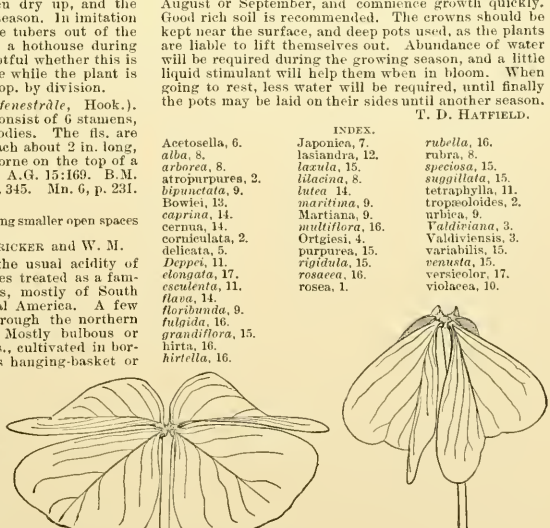

1601. Leaves of Oxalis tetraphylla, showing day and night positions.

A. *Plants without bulbs or scaly rootstocks: stem usually elongated, leafy.*
B. *Lfts. palmately placed, not separated, notched.*
C. *Color of fls. rosy.* ..... 1. **rosea**
CC. *Color of fls. chiefly yellow.*
D. *Peduncles shorter than lvs.* ..... 2. **corniculata**
DD. *Peduncles longer than lvs.*
E. *Foliage clustered.* ..... 3. **Valdiviensis**
EE. *Foliage scattered.* ..... 4. **Ortgiesi**
BB. *Lfts. pinnately placed, somewhat separated, entire.* ..... 5. **delicata**
AA. *Plants with underground stems thickened and scaly at end, forming a sort of tuber: stem scarcely any: lvs. of 3 lfts.*
B. *Fls. white, with rosy veins.*
C. *Lfts. obcordate.* ..... 6. **Acetosella**
CC. *Lfts. broadly triangular, scarcely notched.* ..... 7. **Japonica**
BB. *Fls. rosy, lilac, or white.* ..... 8. **rubra**
AAA. *Plants from loose, scaly, ovoid bulbs: stem scarcely any: fls. umbelled on elongated scapes. American species.*
B. *Lfts. 3.*
C. *Bulb composed of numerous small ones* ..... 9. **Martiana**
CC. *Bulb simple* ..... 10. **violacea**
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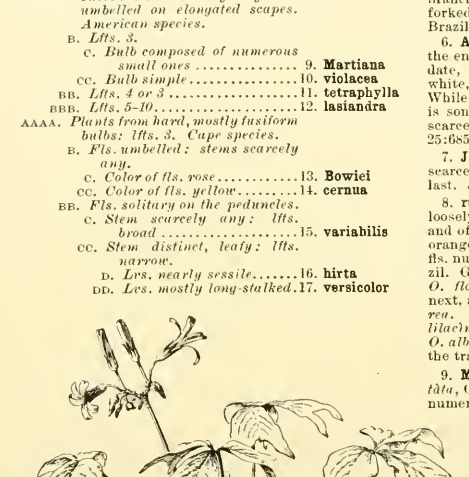
AAAA. *Plants from hard, mostly fusiform bulbs: lfts. 3. Cape species.*
B. *Fls. umbelled: stems scarcely any.*
C. *Color of fls. rose* ..... 13. **Bowiei**
CC. *Color of fls. yellow* ..... 14. **cernua**
BB. *Fls. solitary on the peduncles.*
C. *Stem scarcely any: lfts. broad* ..... 15. **variabilis**
CC. *Stem distinct, leafy: lfts. narrow.*
D. *Lvs. nearly sessile.* ..... 16. **hirta**
DD. *Lvs. mostly long-stalked.* 17. **versicolor**



1602. Oxalis Ortgiesi.

1. **rósea,** Feuil. Stem elongated, erect: lvs. scattered, rather short-petioled; lfts. obcordate: fls. in open, irregularly forked cymes on elongated axillary peduncles, rather large, rosy, with deeper veins. Chile. B.M. 2830. B.R. 13:1123 (as *O. floribunda*). *O. Simsii,* Sweet, scarcely differs, except in its darker red fls. Chile. B.M. 2415 (as *O. rosea*).

2. **corniculàta,** Linn. Slender, prostrate, often rooting, loosely hairy: lfts. obcordate: fls. usually 2 to 3 together, small, yellow.—A tropical form of this polymorphous species is universal as a greenhouse weed, especially in Agave and Cactus tubs.

Var. **atropurpùrea,** Planch. (*O. tropæoloìdes,* Schlachter). Ascending, tufted, with deep purple-red stems and foliage. Sometimes used for beds or borders, and for carpeting large tubs, etc. Eu. F.S. 12:1205; 19:1968. R.H. 1897, p. 499.

3. **Valdiviénsis,** Barn. (*O. Valdiviàna,* Hort.). Short-stemmed: lvs. clustered, long-petioled; lfts. obcordate: fls. closely umbelled on erect, elongated peduncles, yellow, with reddish veins. Chile.

4. **Órtgiesi,** Regel. Fig. 1602. Stem elongated, erect, rather fleshy and usually reddish: lvs. scattered, often on long, colored petioles; lfts. red below, cuneate, with broad V-shaped notch at end: fls. very short-stalked, in forked cymes on elongated peduncles, small, yellow, with deeper veins. Peru. Gt. 1875:817.

5. **delicàta,** Pohl. Stem erect, elongated, slender, branching: lfts. ovate or lance-ovate, acute: fls. in forked cymes on elongated peduncles, small, pale rose. Brazil.

6. **Acetosélla,** Linn. Wood Sorrel. Rhizome slender, the ends scarcely thickened, densely scaly: lfts. obcordate, not orange-dotted: fls. solitary on the scapes, white, with rosy veins. Eu., N. Amer. Gn. 47, p. 129.—While a charming plant for the wood-garden, this, which is sometimes held to be the original Irish Shamrock, scarcely enters into ordinary gardening. G.C. II. 25:685.

7. **Japónica,** Franch. & Sav. Lfts. broadly triangular, scarcely notched, truncate. Otherwise similar to the last. Japan.

8. **rùbra,** St. Hil. Rhizome thickened at ends into loosely toothed tubers, sometimes nearly an inch thick, and often clustered: lfts. obcordate, more or less hairy, orange-dotted beneath: inflorescence mostly compound: fls. numerous, umbelled, rosy, with deeper veins. Brazil. Gn. 50, p. 511 (as *O. floribunda*).—Usually cult. as *O. floribunda,* which name properly belongs to the next, and sometimes, but also erroneously, as *O. arborea.* A lilac-flowered form passes erroneously for *O. lilacina,* and a white form for *O. arborea,* var. *alba* or *O. alba;* and *O. violacea* and *O. violacea* var. *alba* of the trade seem to be this species and its variety.

9. **Martiàna,** Zucc. (*O. árbica,* St. Hil. *O. bipunctàta,* Grah. *O. floribúnda,* Lehm.). Bulbs composed of numerous small ones: lfts. obcordate, somewhat hairy, with a marginal row and some scattered dots of orange color beneath: umbels usually compound: fls. rose-purple. Trop. Amer. B.M. 2781; 3938. —By a misprint this is sometimes advertised as *O. maritima.*

10. **violàcea,** Linn. Bulb simple: lvs. rather fleshy, glabrous: fls. in simple umbels, rose-violet. Eastern U. S. B.M. 2215. Mn. 5:121.—Scarcely useful, except for hardy borders, rockeries, etc., and transient.

11. **tetraphýlla,** Cav. (*O. Déppei,* Lodd.). Lfts. 3 or 4, deltoid, truncately notched, each crossed by a purplish band: fls. rather few, lilac to deep rosy. Mexico. L.B.C. 8:790; 15:1500. G.M. 39, p. 403. Gn. 8, p. 43.—Sometimes called *O. esculenta,* because of the large fusiform roots beneath the bulbs. See Fig. 1601.

12. **lasiándra,** Zucc. Lfts. 5 to 10, oblong-spatulate, not notched, several inches long, radiately pendent about a reddish disk at end of petiole: fls. crowded, rosy crimson. Mexico. B.M. 3896.

13. **Bòwiei,** Herbert. Plant low: lvs. large; lfts. rather fleshy, broadly obcordate, deep green: fls. large, loosely clustered, bright rose-red. Cape. B.R. 19:1585. B. 1:25. R.H. 1858, p. 120. Gn. 10, p. 159.

14. **cérnua,** Thunb. Fig. 1603. Lfts. broadly obcordate, deeply notched, often purplish: fls. large, compactly clustered, bright yellow. Cape. L.B.C. 12:1154.

B.M. 237(as *O. caprina*). A double-fld. form naturalized about the Mediterranean is also commonly cult. F.S. 19:1964.—Both the single and double forms are frequently but wrongly listed as *O. lutea* and *O. flava*, and sometimes as *O. caprina*, and the popular name of Bermuda Buttercup is becoming attached to them

1603. Oxalis cernua.

15. **variábilis**, Jacq. (*O. variábilis*, var. *albiflòra*, Lindl. *O. grandiflòra*, Jacq. *O. lâxula*, Jacq. *O. purpùrea*, var. *lâxula*, Hort. *O. rigidula*, Jacq. *O. suggildàta*, Jacq.). Lvs. large, rather fleshy, sometimes purplish, petioled: fls. large, white or slightly variegated with rose color, yellowish at base. Cape. B.M. 1683.

Var. **rùbra**, Jacq. (*O. purpùrea*, Jacq. *O. speciòsa*, Jacq. *O. venùsta*, Lowe). Fls. rosy to deep rose-purple. Cape. B.R. 18:1505. B.M. 1712.

16. **hirta**, Linn. (*O. rosàcea*, Jacq. *O. multiflòra*, Jacq. *O. rubélla*, Jacq. *O. hirtélla*, Jacq. *O. fúlgida*, Lindl.). Lvs. nearly sessile: lfts. spatulate: fls. from lavender or pale rosy (var. **rosea**) to deep rose color. Cape. B.R. 13:1073. B.M. 1031. L.B.C. 3:213.

17. **versicolor** (*O. elongàta*, Jacq.). Glandular: lvs. and peduncles clustered at end of simple stems; petioles mostly elongated; lfts. linear-wedge-shaped: fls. white, yellowish below, the petals bordered with red, opening only in full sunshine. Cape. B.M. 155. F.S. 8:834.

WM. TRELEASE.

OXÈRA (meaning dubious). *Verbenàceæ*. It needs but a glance at any of the colored portraits of *Oxera coccinea* to show that it is one of the most interesting climbers cultivated in our hothouses. It has ivory-white, trumpet-shaped, sweet-scented fls. 2 in. long and 1 in. across, borne profusely in clusters of a dozen or more. A plant 2 years old from cuttings will completely clothe the rafters and bloom freely, the weight of the clusters causing the fls. to droop gracefully. The prominent calyx reminds one of *Clerodendron Thompsonæ*, a distinguished favorite and near relative. As the cylindrical part of the corolla-tube leaves the calyx it makes a sharp bend and then broadens out into a funnel-shaped flower, with the 4 lobes scarcely spreading. The spirited appearance of the fls. is enhanced by the long style and the 2 stamens, which are thrust out and strongly curved.

Oxera is a genus of 10 species of shrubs, often climbers, all from New Caledonia. Lvs. opposite, entire, leathery: fls. whitish or yellowish, in twice- or thrice-forked cymes, varying greatly in form of calyx and corolla, but the latter always 4-lobed, and wide-throated: drupes 4-parted or by abortion reduced to a single segment.

pulchélla, Labill. Lvs. 2–5 in. long, stalked, the lower ones oblong-lanceolate: calyx conspicuous, loose, composed of 4 more or less united greenish yellow sepals, each ½–¾ in. long. Gn. 33:651; 45, p. 333. I.H. 36:76. J.H. III. 30:33. B.M. 6938. G.C. III. 3:209. R.H. 1890, p. 274.—Once offered by John Saul, Washington, D. C. Also cult. outdoors in S. Calif.

OX-EYE. In America, *Heliopsis*; in Europe, *Buphthalmum*. **Ox-eye Daisy.** *Chrysanthemum Leucanthemum* and *Rudbeckia hirta*.

OXLIP. *Primula elatior*.

OXYÁNTHUS (Greek, *sharp flower;* referring to the acute lobes of the corolla and calyx). *Rubiàceæ*. A genus of 15 species of African trees and shrubs, allied to the Cape Jasmine and to *Gardenia citriodora*. They are remarkable for their extremely long and slender corolla-tubes, which are topped by a 5-pointed star of spreading, narrow lobes. The fls. are sometimes 5–6 in. long, and 2 in. across in cultivation. Lvs. opposite: fls. usually white, in axillary racemes or panicles; calyx-tube truncate, or with 5 short teeth; corolla salver-shaped, throat glabrous; stamens 5, inserted at the mouth of the tube: ovary 2-celled, except in 1 species; style usually exserted; stigma usually spindle-shaped or club-shaped, 2-cut at the top: ovules numerous, not immersed in the 2 fleshy placentæ: fr. a sort of berry. Twelve species are described in the Flora of Tropical Africa, 3 in Flora Capensis.

Natalénsis, Sond. Branches, lvs. and calyx glabrous: lvs. elliptic-oblong or ovate-lanceolate, shortly acuminate, 7–8 in. long, 3 in. wide: racemes axillary, loosely 16–20-fld.: fls. white; corolla-tube about half the length of the lvs. Wet places in woods near Durban, Natal. Cult. outdoors in S. Fla. and in Eu. under glass.

O. tubiflòrus, DC. Hispidulous-puberulous: lvs. obtusely rounded or somewhat eared at the base: fls. 6–7 in. long, at first creamy white, then tawny or ochrous: fr. terete, not grooved. Trop. Africa. B.M. 4636. F.S. 7:737. B.M. 1992 (as *O. speciosus*). W. M.

OXYCÓCCUS. See *Vaccinium*.

OXYDÉNDRUM (Greek, *sour tree;* from the acid taste of the foliage). Also written *Oxydendron*. *Ericàceæ*. SOUR-WOOD or SORREL-TREE. A genus of one species, a North American tree 15–40 ft. high, bearing numerous small white tubular fls. in early summer. Its chief beauty lies in the character of its inflorescence (see Fig. 1604), which is a panicle composed of 6 or more racemes, each about 3–6 in. long and bearing as many as two dozen pendent fls. It is also valued for its highly colored autumn foliage. It is of rather slow growth and is useful in shrubberies, along the borders of woods, or even within the woodland, since it endures shade fairly well. It is of easy culture in any moderately good soil, but rather slow in becoming established.

This tree is one of many known to nurserymen as Andromedas. The prevailing tendencies among botanists to-day distribute these species in many different genera, leaving only *A. polifolia* in Andromeda as strictly defined. *Andromeda arborea* is made a monotypic genus called Oxydendrum, based on the following characters: calyx cut into 5 separate sepals which overlap more or less in the young buds: corolla ovoid-cylindrical, crowned with 5 short teeth: anthers long, linear, blunt on the back, opening by long chinks down the front: capsule woody; seeds numerous, needle-shaped.

arbóreum, DC. (*Andrómeda arbórea*, Linn.) SOUR-WOOD. SORREL-TREE. Fig. 1604. Smooth-barked tree attaining a maximum height of 60 ft., with trunk 15 in. thick: lvs. deciduous, membranous, oblong or lanceo-

late, 3-6 in. long, glabrous, veiny, slender-stalked: clusters borne on leafy shoots of the season: fls. opening slowly. Rich woods, Pa. and Ohio, along the Alleghenies to Fla. B.M. 905. B.B. 2:571. S.S. 5:235.

F. W. Barclay and W. M.

1604. Sour-wood or Sorrel-tree, Oxydendron arboreum (×⅛).

OXYLÒBIUM (Greek, *sharp pod*). *Leguminòsæ*. This is one of many genera of Australian shrubs with pea-like fls. which are little known in cultivation. For winter bloom under glass none of them equals *Cytisus Canariensis*. Oxylobium is a genus of 28 species, of which perhaps a dozen have been cult. in Europe. Their fls. are yellow, or more or less flushed with red on the keel or the base of the standard. *O. Callistachys* is perhaps the best for conservatories. In America it is cult. only in S. Calif.

Generic characters: lvs. very short-stalked, opposite or more or less whorled, rarely scattered or alternate: fls. in terminal or axillary racemes; petals clawed; stamens free: ovary villous, sessile or stalked, 4–30-ovuled. Nearest to Chorizema, but the keel is about as long as the wings, while in Chorizema the keel is much shorter. The following species was considered the type of another genus; it is distinguished from all other species of Oxylobium by the incomplete dehiscence of the pod. See Flora Australiensis 2:14 (1864).

Callistachys, Benth. Tall shrub: lvs. mostly in irregular whorls of 3, varying from ovate-oblong and 1½–2 in. long to lanceolate and 4–5 in. long, leathery, silky-pubescent beneath when young: racemes oblong or pyramidal, 2–6 in. long. B.R. 3:216 (as *Callistachys lanceolata*). B.M. 1925 (as *C. ovata*). P.M. 8:31 (as *C. longifolia*). L.B.C. 20:1983 (as *C. retusa*). J.H. III. 35:35.

OXYPÉTALUM (Greek, *sharp petal*). *Asclepiadàceæ*. *O. cæruleum* is a tender twining herb from the Argentine Republic with changeable 5-lobed fls. about an inch across. The fls. are said to be pale blue when they first open, then purplish, and when withered lilac. Not cult. in America, but apparently desirable for cultivation here. The following are perhaps obtainable from Europe: *O. appendiculatum*, with pale yellow, fragrant fls.; *O. Banksia*, with purple fls., and *O. solanoides*, blue, tinged rose.

Oxypetalum is a genus of about 50 species, mostly South American and largely Brazilian herbs or subshrubs, twining or not: lvs. opposite: calyx 5-parted: corolla deeply 5-cut, short-tubed: scales of the corona 5, fastened at the base of the corolla and staminal tube.

cærùleum, Done. Downy: lvs. short-petioled, oblong, one of each pair of the upper lvs., 3–4-fld.: corolla-lobes but cordate-hastate at the base: peduncles axillary from spreading: scales of the corona 5, erect, darker blue, fleshy, exserted, recurved and notched at the apex. B.M. 3630 (*Tweedia versicolor*).

OXÝTROPIS (Greek, *sharp keel*). *Leguminòsæ*. Three Colorado wild flowers are offered under this name. The fls. are pea-shaped, borne in spikes, and range from white through blue and purple to crimson. The plants are tufted, and the lvs. are odd-pinnate, have 7–16 pairs of lfts., and are often woolly white beneath. *O. Lamberti* is one of many plants that have been charged with being the "Loco weed" which ruins western horses. This genus, according to E. L. Greene (Pittonia 3:208), should be referred to Aragallus. Aragallus is reviewed in Erythea 7:57–64 (1899), but the genus is not defined. It is closely related to Astragalus, and differs essentially in the pods being usually 2-celled instead of 1-celled. About a dozen kinds of Old World Oxytropis said to be cult. in Europe, mostly in rockeries. They are hardy, easily prop. by seed or by division, and prefer a dry, sandy loam. These plants are of very minor value horticulturally.

A. *Stipules free: pod 1-loculed.*

defléxa, DC. (*Aragállus defléxus*, Heller). A foot or less high: lfts. crowded in 12–16 pairs, lanceolate to oblong, 3–6 lines long: fls. about 3 lines long: pod 1-celled. Mts., Brit. Amer. to Colo. and Utah.—Very distinct species, by reason of its stipules.

AA. *Stipules adnate to the petiole: pod 2-loculed.*

Lámbertii, Pursh (*Aragállus Lámberti*, Greene). Lfts. about 7 pairs, 4–16 lines long: spike sometimes short-oblong, densely fld., often long and sparsely fld.: fls. 1 in. across, typically purple or violet; calyx not inflated, distinctly surpassed by the mature pod: pod turgid but not membranous-inflated, more or less leathery, subterete, neither glandular nor viscid, imperfectly 2-loculed or less. Common on the prairies. B.M. 2147 (dark blue). B.R. 13:1054 (blue). V. 3:138.—Aven Nelson, in Erythea 7:62, says that the species should be restricted to the purple- and violet-fld. forms. D. M. Andrews offers a crimson-fld. form, and also var. **spicàta,** which has large spikes of white fls. W. M.

OXYÙRA. See *Layia*.

OYSTER PLANT or SALSIFY. *Tragopogon porrifolius*.

P

PACHÌRA (native Guiana name). *Malvàceæ*. A genus of about 30 species of tropical American trees with odd and showy flowers. The fls. may have a spread of 9 inches. Their chief beauty is their immense mass of stamens; but their petals are also striking. These are very long and narrow, e.g., 6 x 1 in., and gracefully recurved, with wide spaces between. The finger-shaped foliage also gives the trees a distinct appearance. Pachiras are all natives of South America, except 2 species which are found in Mexico and 2 in the West Indies. One is offered in S. Fla. The others here mentioned have been cult. under glass abroad, but as a group Pachiras are not suitable for conservatory culture, because they grow too high and require too many years' growth before they flower. They are of easy culture in a warmhouse and grow rapidly. Sometimes called Silk Cotton Trees.

Generic characters: lvs. palmate, cup-shaped, truncate or sinuate: column divided above into very many filaments: petals downy outside: capsule 5-celled, loculicidal: seeds many, glabrous. Pachira's nearest allies are Adansonia (the baobab tree) and Bombax, both of which are cult. Bombax differs from the other two genera in having its capsule densely woolly inside. Adansonia has a 5-cut calyx, while in the other two genera the calyx is truncate.

aquática, Aubl. Lfts. glabrous, 5–9 (usually 5), elliptic-oblong, obovate-oblong, or elliptic-lanceolate, subsessile: calyx truncate, warty-wrinkled; petals 8 in. long, 6–8 lines wide, greenish white: column divided above into 10 paired outer and 5 inner bundles of filaments, each forking and bearing 10–30 stamens in pairs: color of filaments yellowish purple: stigma obscurely 5-lobed. Trop. Amer., West Indies.

P. álba, Walp. Less desirable because it flowers at a time when the tree has no foliage. Petals yellowish white inside: filaments white. Winter. Brazil (or New Granada?). B.M. 4508. L.B.C. 8:752 (as Carolinea alba). Odor powerful and somewhat unpleasant.—*P. insignis*, Savign. Petals crimson: filaments white. Mex. L. B. C. 11:1004 (as Carolinea insignis). Fragrance powerful. Fruit said to be as large as a child's head; the seeds of the size, appearance and taste of chestnuts.—*P. longifólia*, Walp. Evergreen, and has flowered under glass at a height of only 4 ft. Petals white: filaments yellow below, red above. Mex. B. M. 4549.—*P. macrocárpa*, of Nicholson's Dict. Gard. (not of Walpers), seems to be P. longifolia.—*P. minor*, Hemsl. Petals much narrower than in the others here described, and green: filaments red. Mex. B.M. 1412 (as Carolinea minor).

W. M.

1605. Pachysandra procumbens.
Leaves × ¾. Flowers natural size.

PACHÍSTIMA (said to be derived from Greek, *pachys*, thick, and *stigma;* alluding to the slightly thickened stigma; spelled also *Pachystima* and *Pachystigma*). *Celastràceæ*. Low evergreen shrubs with small opposite lvs. and inconspicuous reddish fls. in the axils of the lvs.: fr. a small oblong capsule. They are hardy with slight protection in the Arnold Arboretum, Boston, and are handsome dwarf evergreens for rockeries or rocky slopes, but still rare in cultivation. They seem to grow in any well-drained soil and prefer sunny positions. Prop. by seeds or by layers; also by cuttings of half-ripened wood under glass. Two species in the mountains of North America, allied to Euonymus. Branches somewhat quadrangular, verrucose: lvs. with minute stipules: fls. perfect, small, in few-fld. axillary cymes; calyx-lobes, petals and stamens 4: ovary 2-celled, usually only one cell developing into a small, oblong, 1-seeded capsule.

Myrsinites, Raf. (*Mygínda myrtifólia*, Nutt. *Orothíla myrtifólia*, Nutt.)., Spreading shrub, to 2 ft.: lvs. broadly elliptic to oblong-obovate, slightly revolute at the margin and serrulate or almost entire, ½–1 in. long: fls. short-stalked, reddish: fr. about ⅛ in. long. May–July. Brit. Col. to Calif. and North Mex.—Resembles the small-leaved form of *Euonymus radicans*, but of more rigid and stiff growth.

Cánbyi, Gray. Dwarf shrub with trailing and rooting branches: lvs. narrow-oblong, occasionally obovate, revolute and usually serrulate above the middle, ½–¾ in. long: fl.-stalks filiform, longer than half the leaf: fls. reddish. April, May. Mts. of Va. Mech. Nat. Flow. 1, 1:44.—This is somewhat similar in habit and foliage to *Euonymus nanus*, but less vigorous. Sometimes called Rat Stripper.

ALFRED REHDER.

PACHYRHÌZUS (*thick-rooted*). *Leguminòsæ*. Probably only 2 species. They are strong twining plants with axillary fascicles or racemes of blue or reddish narrow fls. and 3-foliolate, pinnate lvs.: fr. a compressed legume, with depressed spaces between the seeds. They bear very large tuberous roots, which are used for food and as a source of starch. *P. angulátus*, Rich., is widely spread in the tropics of both hemispheres. The thick tuberous root often weighs 50 to 70 lbs., and attains a length of 6–8 ft., increasing in size for four or five years. Some writers describe the root as turnip-shaped, and it is so figured in Blanco's "Flora de Filipinas." When young, the roots are palatable. The lfts. of this species are 3–4 in. across, the standard of the papilionaceous fls. roundish ovate, and the legume nearly smooth, straight, 6–9 inches long. *P. tuberósus*, Sprengel, is tropical American, producing edible pods larger than those of *P. angulatus*, and with rather smaller tubers.

L. H. B.

PACHYSÁNDRA (Greek, *thick stamen*). *Buxàceæ*, which is often united with *Euphorbiàceæ*. Prostrate perennials from rootstocks, 6–12 in. high, scaly below, with alternate, usually deeply toothed, evergreen or de-

ciduous, 3-nerved broad lvs. above: spikes staminate above, with a few pistillate fls. at the base of each: staminate fls. with 4 sepals and stamens and a rudimentary pistil; sepals variable in number in the pistillate flowers; petals none; pistil 3-celled, 2 ovules in each cell: seeds smooth. Two species knowu; of low and dense growth. Very early flowered and attractive to bees. Of little value in gardens except for the masses of bright green lvs. Easily prop. by division in ordinary soils. Good for rockeries.

procúmbens, Michx. MOUNTAIN SPURGE. Fig. 1605. With spikes of white or purplish fls. from the base of the stems. March–May. W. Va. to Fla. B.M. 1964. L.B.C. 10: 910. B.R. 1: 33.

terminàlis, Sieb. & Zucc., has the small spikes of whitish fls. terminal, and the lvs. obovate-cuneate; dwarf. May. Japan. Var. **variegàta,** Hort., with white variegated lvs., is in the trade.

P. coriàcea, Hook., cult. in Europe, is referred to Sarcococca. J. B. S. NORTON.

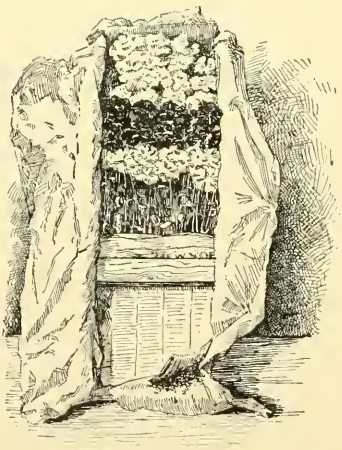
P. procumbens is, in the vicinity of Boston, deciduous, and is only desirable from the feature of its curious flowers borne so extremely early in the spring. The foliage is of a dingy color and deciduous, whereas *P. terminalis* is a true evergreen with thick, glossy foliage forming a dense mat, making a very desirable low-growing cover plant, succeeding admirably either in full sun or partial shade. The variety *variegata* is a very choice cover plant for ornamental effects.

J. WOODWARD MANNING.

PACHÝSTIMA. See *Pachistima.*

PACKAGES. See *Packing.*

PACKING. The operation of placing fresh fruits and vegetables, cut-flowers or living plants in suitable baskets, boxes, barrels or bales for safe transportation. (The term is also sometimes used for the process of canning or preserving cooked fruits and vegetables when done on a commercial scale.) The term is especially employed



1606. Packing of cut-flowers.

when perishable horticultural products are prepared for long shipment. Much of the value of such products for distant markets depends on proper packing. With transported nursery stock of all kinds the life of the plants depends on it, while with fruits, vegetables and cut-flowers the attractiveness and salability of the product are very largely determined by the care and judgment with which the goods are packed.

The requisites for the proper packing of living plants are: (1) that the roots be protected from injurious drying by a covering of some damp material, (2) the partial exclusion of the air, and (3) that ventilation be sufficient to prevent the heating of the contents of the package. Bog moss (sphagnum) is the material com-

1607. Berry crate, holding 32 boxes.

monly used to prevent the drying out of the roots. Moistened hay, straw, chaff, planer shavings, or other similar material is sometimes substituted for the moss, or used in connection with it.

Small plants, as strawberries, cabbages, etc., are often packed upright, one layer deep, in light, paper-lined baskets, with the roots bedded in moist sphagnum, the plants being crowded together so closely as to prevent undue drying. Small plants in pots may be shipped in the same way, or, if the time occupied in transit does not exceed 3 or 4 days, they may be knocked from the pots and wrapped in paper with the ball of earth still adhering to the roots. Paper pots are also manufactured for this and other purposes. These paper bundles are then placed in any convenient box or crate.

Fruit trees and most other dormant nursery stock are packed in large boxes, or in bales covered with straw and bagging, enough sphagnum and other packing material being used to keep the contents slightly moist. Large shipments of nursery stock are often made by packing in bulk in the car, thus saving the expense of boxes.

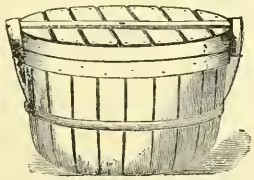
Cut-flowers are necessarily perishable, but the kinds most used by florists may be kept in good condition for several days if they are so packed as to avoid crushing and to maintain a cool, water-saturated atmosphere. This condition is best secured by placing the flowers a single layer deep, in light, shallow boxes or trays that are placed one on top of another and strapped together for shipment. Each tray is lined with a sheet of oiled paper large enough to fold over the top and to protect the contents from drying. Sufficient moisture is secured by using damp paper for packing about the stems. A cool temperature is essential, and should be secured by refrigeration if necessary. Fig. 1606.

1608. Delaware peach basket.

The methods of packing fruits and vegetables necessarily differ widely with the nature of the articles to be packed, and for the same product custom often has established different practices in different parts of the country. Formerly, it was the habit in many markets to return empty packages to the shipper, so that they could be used over and over again. With the vast increase in distant shipments, due to improved transportation facilities, this became impossible, and now cheap gift packages intended to be used but once are coming into favor and in some regions are used exclusively.

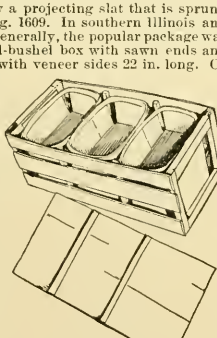
For berries of all kinds, and other small fruits, quart

boxes or baskets, made of thin veneers fastened together with tacks or with wire staples, are generally used, though pints and even smaller sizes are popular in some markets, especially for such delicate fruits as raspberries. Square baskets, a little larger at the top than at the bottom, are preferred at the East, while in the Mississippi valley the square "Hallock" or oblong "Leslie" boxes are mostly used. In either case a certain number, usually either 16, 24 or 32, are placed in light slat crates for shipment. Fig. 1607. The boxes or baskets are filled in the field by the pickers. They are inspected more or less thoroughly at the packing house, where the process of packing usually consists in arranging the top layers so that the box or basket shall be evenly, but slightly, rounding full, so as to avoid crushing, and yet not seem slack-filled on reaching market. In some cases, notably in Florida, the boxes are emptied and repacked from the bottom.



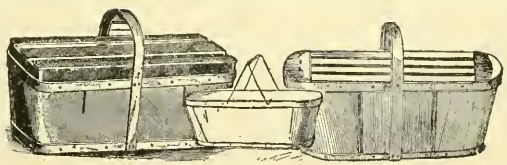
1609. Bushel basket with cover.

Peaches are regularly marketed in a greater variety of packages than any of our fruits. In Georgia and neighboring southern states, a light crate holding 6 4-quart baskets is used. In Delaware and throughout the peninsular region, a round, rather deep basket holding five-eighths of a bushel is used. Fig. 1608. It has no handle and usually no cover, and ears have to be specially shelved for carrying it. In New Jersey, the Hudson River country, and New England, a similar basket is used, but holding only 16 quarts. In Michigan custom varies, but the bulk of the shipments are in long, flat-handled baskets of various sizes — quarter, third, and half bushel. The fruit is usually covered with colored netting, and it is sometimes further protected by slat covers. Another Michigan package is a rather heavy, round bushel basket, with small side handles and a stout cover, held in place by a projecting slat that is sprung under the handles. Fig. 1609. In southern Illinois and the Mississippi valley generally, the popular package was for many years a third-bushel box with sawn ends and middle-piece 5 x 8 in., with veneer sides 22 in. long. Of late years it has been replaced, to some extent, by 4-quart baskets like those used in Georgia, but packed one layer deep in 4-basket crates. California peaches always come in rectangular 20-pound boxes, each fruit carefully selected and wrapped in paper. With the larger of these packages, like the bushel and five-eighths bushel baskets, the act of packing consists, as with strawberries, in simply arranging the top so as to secure the desired fulness, but with the smaller packages it becomes a rather difficult art to so place each fruit that the package shall be full, and yet have none of the top layers stand high enough to be crushed by the cover. If the fruits chance to run of just such size that the package can be evenly filled by packing in uniform layers, one on top of another, the problem is comparatively simple. Thus, with the Georgia 4-quart basket, some of the small early kinds, like Tillotson, often run so that three layers deep just fills the basket properly. Again, with the largest Elbertas, two layers, one on top of the other, are sufficient, but the great bulk of the crop will not pack on either of these plans, and it is necessary to introduce a broken layer between the bottom and top layers. Such packing requires skill and experience in order to produce satisfactory results. When the fruits run unevenly in size they must be assorted or they cannot be packed conveniently. It is slower and more expensive than simply dumping the fruit into large baskets, but delicate fruits, like peaches, endure distant shipment much better in small than in large packages, and experience is constantly demonstrating that extra care in assorting and packing fruit is always well paid for by increased market prices.



1610. Six-basket crate.
Used for tomatoes and peaches in Georgia and Florida.

All of these packages, or modifications of them, are also used for plums, pears, early apples, tomatoes and many other products. Which one to select for use in any given case will depend on the character of the product, the distance from market, the available supply of skilled labor and on the usages and preferences of the market to be supplied. The latter is an important factor and one that sometimes changes in the same market with different seasons of the year. Thus, with tomatoes in Chicago and other western markets, the supply early in the spring is largely from Florida, where the custom is to pick green, wrap in papers and pack in the Georgia 6-basket crate. Fig. 1610. This style of package and of packing now dominates the market and is the recognized standard for tomatoes during March and April. During the last of May and first of June, Mississippi tomatoes begin to appear in these markets in increasing quantities. These are packed without wrapping, in flat 4-basket crates. Being fresher than the Florida stock, they are preferred by the trade, and from this time on wrapped tomatoes in 6-basket crates are distinctly at a discount, even if of good quality.

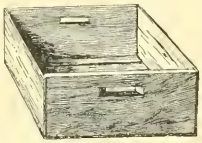


1611. Forms of Climax baskets.

Grapes are likewise marketed in a variety of packages. At the South they are often shipped in the 6-basket crate. Fancy kinds are sometimes packed in round 3-pound boxes that are crated for shipment. The great bulk of the grape crop outside of California is, however, packed in 5–10-pound Climax baskets. Fig. 1611. These are oblong baskets with a handle. They are made with sawn bottoms and solid veneer sides, with a solid veneer cover fastened down with wire hooks. California grapes are packed in square 5-pound baskets made of two pieces of thin veneer crossed over the bottom, and bent up to form the sides, with the top ends of the veneer held in place by a light tin binding. Four, or sometimes eight, of these baskets are placed in a crate, making a 20- or 40-pound package. In many places, the grapes are cut from the vines some hours in advance of packing, so that the stems may lose their brittle freshness and become limp enough to lie close together, thus preventing undue shrinking in transit. Each bunch is carefully examined and all imperfect berries are removed with sharp-pointed clippers. The packer should incline the basket in such a way that the packing may begin in one end, thus allowing the top, or face, to be made of the

smoothly overlapping tips of the clusters with no stems showing.

Pears at the East are packed in barrels, half barrels or kegs, or in some of the various peach packages. In California they are all wrapped in paper and are carefully packed in 40-pound boxes.



1612. A bushel box.
Useful for fruits and vegetables.

Until within the last few years the barrel was the almost universal apple package, and it is still used for handling the great bulk of the crop. Early, perishable kinds have, however, long been shipped in the various peach packages. Recently, the growers of the Pacific coast have led the way in packing winter apples in boxes. They are wrapped after the manner of California pears. Some eastern growers are finding it to their advantage to follow this western fashion for their fancy fruits, and it seems probable that the better grades of apples at least will come more and more to be marketed in smaller packages. In Boston, a bushel box is now popular for apples and other products. Fig. 1612. In packing apples in barrels it is customary to place the first one or two layers by hand, turning the stem ends all down. This is called facing. The barrel is now filled, a basketful at a time, by lowering the basket into the barrel and carefully turning out the fruit. The barrel is shaken occasionally so as to settle down the fruit, and when the top is reached it is rounded up enough so that the head has to be pressed into place with considerable force, a long lever or a special barrel press being used for the purpose. The barrel is now turned over, and what was the bottom is marked as the top, so that the hand-laid "face" may be exposed on opening. For vegetables, various open-work or ventilated barrels are in use. Fig. 1613.

The requisites for the proper packing of any fruit or vegetable are: (1) that the package selected be inexpensive, attractive, favorably known in the market, and suited to carrying the given product in good condition; (2) that great care be taken in assorting, so that only goods of one even quality go in each package; (3) that skill be used in so placing the goods that the package is evenly and solidly filled, thus preventing the shifting and chafing of the contents in transit and yet avoiding crushing by undue pressure; (4) that while an attractive display of the contents is not only allowable but highly desirable, no attempt at misleading as to the nature of the contents is permissible. Nothing in the past has done more to break down prices and curtail the sales of horticultural products than the pernicious habit of dishonest packing. This fact is now fully recognized by all progressive growers.

1613. Ventilated barrel.

F. S. EARLE.

Packing Flowers.—While flowers should not be crushed by being crowded in shipment, it is more often that damage is done by their being too loosely packed and being able to move and shake against one another. In this way the petals are often damaged. The Harrisii and Longiflorum lilies, in fact all the true lilies, are the most difficult of all flowers to pack. They should be so packed that no part of the flower will touch either bottom, top or sides of the box. Several dozen spikes can be tied together and if the flowers are closely interwoven they will do no harm to each other as they will all move together. If this plan is not followed then they must be entirely enveloped in cotton batting.

Orchids, particularly of the Cattleya type, are difficult to pack but travel finely if each spray is fastened to the bottom of the box. Wrap a piece of soft paper around the stem and fasten to the bottom of the box with a small staple

The highest grade of roses, especially of the light-colored varieties, should be wrapped, each flower being in a piece of soft tissue paper. It arrests development of the flower and prevents injury to the outer petals.

The finest blooms of carnations, commanding a high price, should not be tied in bunches of 25, as we have been accustomed to do with cheap flowers. The petals are easily crushed and the flowers have to be kept several hours in water before they assume their perfect form. These fine flowers should be laid in layers with a roll of paper between each layer. Good and perfect packing will always be rewarded with the highest price for the product.

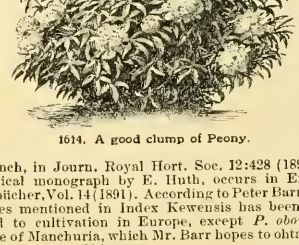
WILLIAM SCOTT.

PÆDÈRIA (Latin, *pædor*, bad smell; referring to *P. fœtida*). *Rubiàceæ*. Fourteen species of tropical shrubby twiners, mostly natives of India, Burma and the Malay Archipelago, but one from Madagascar and one from Brazil. *P. fœtida* is cultivated by G. W. Oliver at the U. S. Botanic Gardens, Washington, D. C. Oliver writes ("Plant Culture," p. 76) that it is "usually grown as a stove and greenhouse climber, but it is hardier than is generally supposed. It is rather an attractive-looking but not free-blooming vine. The leaves, or any part of the plant, when bruised emit a most offensive odor. Cuttings should be put in any time after the growths are matured."

Pæderias are slender plants: lvs. opposite, rarely in whorls of 3, petioled: fls. in axillary and terminal dichotomous or trichotomously branching panicled cymes, bracteolate or not; corolla tubular or funnel-shaped; throat glabrous or villous; lobes 4–5, valvate, with inflexed, crisped margins, tip often 3-lobed. Distinguished from allied genera by the 2-locular ovary and 2 capillary, twisted stigmas.

fœtida, Linn. Glabrous or nearly so: lvs. opposite, long-petioled, ovate or lanceolate, base acute, rounded or cordate: cyme branches opposite: fr. broadly elliptic, much compressed; pyrenes black, with a broad pale wing, separating from a filiform carpophore.

PÆÒNIA (after the mythical physician Paeon). *Ranunculàceæ*. PEONY. PINEY. PÆONY. Peonies are among the dozen commonest and best hardy herbaceous perennials. There is also one shrubby species, *P. Moutan*, called the Tree Peony. Natives of Europe and Asia, only a single species, *P. Brownii*, being found in North America, on the Pacific coast. Roots thickened to form upright rootstocks: lvs. large, alternate, pinnately compound or dissected: sepals 5, persistent; petals conspicuous, broad, 5–10, but doubling may take place in any species by the numerous stamens becoming petals: carpels 2–5 on a fleshy disk; follicles dehiscent; seeds large, fleshy. Common garden forms are shown in Figs. 1614, 1615. Extended accounts of the genus are by J. G. Baker in Gard. Chron. II., 21:732; 22:9 (1884), and R.



1614. A good clump of Peony.

I. Lynch, in Journ. Royal Hort. Soc. 12:428 (1890). A botanical monograph by E. Huth, occurs in Engler's Jahrbücher, Vol. 14 (1891). According to Peter Barr, every species mentioned in Index Kewensis has been introduced to cultivation in Europe, except *P. oborata*, a native of Manchuria, which Mr. Barr hopes to obtain by a personal visit to China.

K. C. DAVIS.

Lady Alexander Macduff
(White)

Tokumanium

Festiva Maxima

Duke of Wellington

Gabreta
(Single Red)

Woodward
(Pink)

Moutan

Rubra triumphans

Peonies

Peonies are rarely attacked by any insect, animal or fungous disease, neither do they require any covering during the severest weather: in fact, they are among the most hardy, showy, and easily grown of all the garden flowers. In delicacy of tint and fragrance, the Peony more nearly approaches the rose than any other flower. The old-fashioned early red "piny," cultivated since the time of Pliny, is still a favorite in our gardens. Nearly all of the one thousand or more named double varieties grown at present have been obtained by crossing the various forms of *P. albiflora* and *officinalis*. In 1855 only 24 double kinds were known in one of the best collections in England. The single-flowering sorts are not so popular as the double ones, for they do not keep as long when cut and fade more rapidly when on the plant.

Soil.—Peonies grow in all kinds of soil, but do best in a deep, rich, rather moist loam. A clay subsoil, if well drained, is very beneficial when blooms are desired, but the tubers ramify more in lighter soil if grown for propagating purposes. In preparing the bed trench the soil thoroughly two or more feet deep, working in a great quantity of good rich cow manure, as the plants are gross feeders. The ground should be kept well tilled, and an annual top-dressing put above the plants in November; this should be forked into the soil the next spring. Peonies should have a liberal supply of water at all times, and especially while in bloom. Liquid manure, when applied during the growing season and at a time when the ground is dry, gives good returns, both in the growth of the plant and size of the bloom.

Planting.—The crowns should be set 2 inches below the surface. In transplanting, it is a good idea to remove all the old earth so as to start with fresh, unimpoverished soil next to the roots. The flowers produced on small divided plants are likely to be imperfect, but when thoroughly established a plant will continue to bloom if undisturbed for upwards of twenty years. During the period of blooming an inconspicuous wire support is desirable, as a heavy rain often beats down the flowers.

Grouping.—The host of ancient and modern varieties available, ranging from purest white to deepest crimson, in such a diversity of form and size, afford great opportunity for the carrying out of extensive color schemes. Peonies do well in partial shade, which prolongs and intensifies the color of the bloom, and therefore can be used to advantage to brighten up somber nooks. The period of blooming for herbaceous Peonies ranges from the middle of May through the month of June. They grow from 1–3 feet high, and are therefore suitable for planting in front of shrubbery, along driveways, and are especially pleasing when entering into a distant vista. When planted in a border with fall-blooming perennials, such as phlox, funkia, etc., their rich glossy foliage is very effective.

1615. Single Peony (×⅓).

1616. Pæonia albiflora.

Forcing.—Lift the plants in October and place in a coldframe where they will be accessible when the time for forcing arrives. When brought under glass, a uniform temperature of 55° to 60° should be maintained. By feeding well with liquid manure, strong blooms can be produced in eight weeks. A two-years' rest is necessary for the plants before being forced again. To secure extra fine blooms on double-flowering varieties, remove the lateral buds as soon as formed. When the first lateral bud is retained instead of the terminal one, a later period of blooming is obtained. The old flowers should be cut off, so that no unnecessary seed follicles will be formed, and thereby exhaust the plant. It is also important to remove the faded foliage on all Peonies in November, so that it may not interfere with the next season's shoots.

There are three methods by which Peonies are propagated: by division of roots (the most prevalent), by grafting, to increase rare sorts, and by seeds, to obtain new varieties.

Division of Roots.—This is the easiest and most satisfactory method. The roots may be lifted and divided any time from the middle of August until the stalks appear again in the spring. The best time, however, is in the early fall, when the cut surfaces soon callus over and new rootlets form before the frost sets in. Take a large stool, cut off the leaves and separate into as many divisions as can be made with an eye to each tuber. In digging, care should be taken that all of the tubers are dug up, for if not they may remain dormant a season and then produce a shoot, giving rise to the many stray plants which are frequently found in old beds. Tubers divided without an eye should also be planted, as they often act in a similar manner and make a showing above ground in two years' time. Peonies, like most tuberous plants, when dormant stand considerable exposure and can be shipped long distances with safety.

Grafting.—This method is resorted to in herbaceous Peonies when new and rare varieties are to be rapidly increased. An eye of the desired sort is inserted into the tuber of some strong-growing variety, from which all the previous eyes have been removed. This operation is generally performed in August. They should be placed in frames for the winter and transplanted the next year into nursery rows.

Seeds.—Propagating by seed is somewhat tedious, and is only resorted to for increasing distinct species and for obtaining new varieties by hybridization. The seeds should be gathered as soon as ripe and kept damp until sown in November. A mulch during the first season will keep the ground moist and prevent weeds from growing. Generally two years are required for the seed to germinate and three more before a well-developed bloom can be expected.

Wm. A. Peterson.

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A. *Plants shrubby: disk enveloping the base of the carpels* ..... 1. **Moutan**

AA. *Plants herbaceous: disk not produced to envelop the base of the carpels.*

B. *Petals short and leathery, scarcely exceeding the sepals* ..... 2. **Brownii**

BB. *Petals not leathery, large and expanding, much exceeding the sepals.*

C. *Follicles and plant quite glabrous* ..... 3. **albiflora**

CC. *Follicles tomentose, erect or slightly spreading.*

D. *Lvs. and stem glabrous throughout.*

E. *Lfts. finely dissected* ..... 4. **tenuifolia**
5. **anomala**

EE. *Lfts. not so finely divided* .. 6. **officinalis**

DD. *Lvs. and stem pubescent in the upper part.*

E. *Middle lobe of terminal lft. trifid* ..... 7. **decora**
8. **peregrina**
9. **paradoxa**

EE. *Middle lobe of terminal lft. rarely bifid, never trifid* .. 10. **arietina**

1. **Moután,** Sims (*P. arbórea*, Donn). TREE PEONY. Stem 3–6 ft. or even higher if not cut back, much branched: lvs. glabrous; lfts. more often entire at the base of the plant than above: fls. as in *P. officinalis*, but various in color: follicles numerous, very hairy, rather small. May, June. China. Long cult. there, where varieties are numbered by the hundreds. Var. **rubra-plèna,** Hort. Rose-colored, almost single. L.B.C. 11:1035. Var. **rosea-supérba,** Hort. Fls. much more doubled. Gn. 31:580 (as Reine Elizabeth). F.S. 14:1395–6 (Triomphe de Grand). Var. **vittàta,** Hort. Fls. single, white, rose and flesh color, striped, fragrant. F.S. 7:747. Var. **papaverácea,** Andr. Petals thin and poppy-like, white, with red at center of flower. L.B.C. 6:547. Gn. 38:775; 52:1141, and pp. 324, 225. Var. **Bánksii,** Andr. Fls. much doubled, rose-colored, and large. B.M. 1154.

2. **Brównii,** Dougl. (*P. Californica*, Torr. & Gray). Low: lvs. glaucous or pale, lobes obovate to nearly linear: fls. dull brownish red; petals 5 or 6, thickish, little longer than the concave sepals; outer sepals often leaf-like and compound; flower-stem reclining or recurved; disk many-lobed: follicles 4–5, nearly straight, glabrous; seeds oblong. Early spring or summer. Pacific states. B.R. 25:30.

3. **albiflóra,** Pallas (*P. édulis*, Salisb.). Figs. 1616, 1617. Stem 2–3 ft., often branching and bearing from 2–5 fls.: lfts. 3–4 in. long, oblong, deeper green than *P. Brownii*, veining red; peduncle longer than in *P. officinalis*, often with a large simple bract: outer sepals large, leaf like: petals large, various in color, usually white or pink: follicles often 3–4, ovoid, with spiral stigmas. June. Siberia. B.M. 1756. F.S. 8:812. Gn. 30:576 (var. *Adrian*); 50, p. 170; 51:1123.

Var. **Reevesiàna,** Loud. (*P. Reéresii*, Hort.). A double form, with deep red petals. P.M. 1:197.

Var. **Sinénsis,** Stend. (*P. Chinénsis*, Vilm.). A tall Chinese variety, with large, double, crimson flowers. One of the commonest forms in gardens. B.M. 1768.

Var. **festiva,** Planchon. Fls. double, white, with a few marks of carmine in the center. F.S. 8:790.

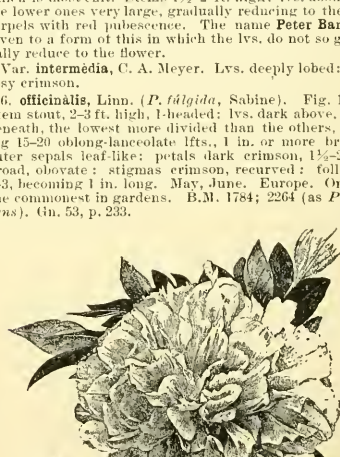
4. **tenuifólia,** Linn. Fig. 1618. Stem 1–1½ ft. high, 1-headed, densely leafy up to the flower: lvs. cut into numerous segments, often less than 1 line broad: fl. erect; petals dark crimson, elliptic-cuneate, 1–1½ in. long; anthers shorter than the filaments; stigma red, spirally recurved: follicles 2–3, about ½ in. long. June. Caucasus region. B.M. 926. A.G. 17, p. 658.—Var. **flore-plèno,** Hort. Fls. dense, double, crimson. F.S. 4:308. Var. **hybrida,** Hort. Fls. rich crimson: lvs. very pretty.

5. **anómala,** Linn. As tall as *P. officinalis*, glabrous: lvs. cut into numerous, confluent, lanceolate, acute segments: fl. solitary, single, bright crimson, very large; outer sepals often produced into compound leafy points; petals obovate to oblong: follicles 3–5, ovoid, arcuate, tomentose or glabrous. Eu. and Asia. B.M. 1754.

Var. **insignis,** Lynch. This is the variety of the above which is most cult. Stems 1½–2 ft. high: lvs. about 10, the lower ones very large, gradually reducing to the fl.: carpels with red pubescence. The name **Peter Barr** is given to a form of this in which the lvs. do not so gradually reduce to the flower.

Var. **intermédia,** C. A. Meyer. Lvs. deeply lobed: fls. rosy crimson.

6. **officinàlis,** Linn. (*P. fúlgida*, Sabine). Fig. 1619. Stem stout, 2–3 ft. high, 1-headed: lvs. dark above, pale beneath, the lowest more divided than the others, having 15–20 oblong-lanceolate lfts., 1 in. or more broad; outer sepals leaf-like: petals dark crimson, 1½–2 in. broad, obovate: stigmas crimson, recurved: follicles 2–3, becoming 1 in. long. May, June. Europe. One of the commonest in gardens. B.M. 1784; 2264 (as *P. pubens*). Gn. 53, p. 233.



1617. Pæonia albiflora.

Var. **alba-plèna,** Hort. Fls. double, white, tinged with red. Gn. 19:265. Garden forms are given trade names, as: **rosea maxima, rosea pallida, rubra,** and many others. These vary in color from nearly pure white to pink and beautiful shades of red.

Some horticultural forms, with nearly single flowers of recent importation and not yet much used, are: **anemonæflòra,** crimson, globular fls., with a mass of twisted crimson stamens, edged with yellow. A.G. 17:663. Gn.

1618. Pæonia tenuifolia (× ⅛).

31:599; *blanda,* pale pink; *lobata,* lvs. distintly lobed: fls. cerise-salmon, a very unusual color; *Otto Froebel,* deep salmon-red; *ròsea,* rich deep rose; *Sabìni,* rich deep crimson petals and yellow stamens. L.B.C. 11:1075; *Sunbeam,* rich cerise-salmon. Some of the largest flowered Peonies, with double flowers, are: *atrorubens plena,* deep blood-red; *Double Anemone-flowered Red; Double Anemone-flowered Rose; Old Double Red; Old Double Rose; Old Double Flesh-White.*

Var. **festìva,** Tausch. Fls. white, with red centers. Native of Europe.

7. **décora,** Anders. Stems 2–3 ft. high: lvs. horizontal, diminishing to the top; lfts. oblong-obtuse: fls. rather small: petals few, small, narrow: peduncle long: follicles hairy, large, spreading from the base when mature. S. Eu. Two garden forms are: *Gertrude Jekyll,* rich crimson; *Monte Gear,* pink.

Var. **Pállasii,** Anders. Lvs. narrow-oblong: fls. rich crimson.

Var. **elàtior,** Anders. Lvs. broadly oblong: fls. rich crimson, very large: receptacle with few processes, and a connection between the carpels at their base of similar surface and appearance to that of the carpels.

8. **peregrina,** Mill. Stems about 1½–2 ft. high: lvs. 5–6 on a stem, deep green and glabrous above, pale green and pilose beneath; otherwise the lvs. and fls. are much like those of *P. officinalis.* Europe. Two beautiful garden forms with double fls. are; *anemonæthéscens sphérica* and *pulchérrima plèna,* the latter differing from the former in the purple shade of crimson fls. The 7 following have recently been imported from England. They have fls. with usually a single whorl of petals: *Blushing Maid,* blush pink; *Brilliant,* bright purple-crimson; *Byzantina,* crimson; *compìcta,* plant dwarf and bushy: fls. crimson: *Exquisite,* soft satiny pink; *Ruby Queen,* bright ruby red; *Seraph,* bright pink.

9. **paradóxa,** Anders. Plant one of the dwarfest: lvs. in a dense tuft; lfts. 3-lobed and incised: fls. purple-red: carpels pressed closely together. Trieste.—Differs from *P. peregrina* hy smaller ovate and more glaucous leaves, leaflets more divided and crowded. Var. **fimbriàta,** Hort. Double purple fls., with projecting purple stamens; very pretty, but not much cult. in America.

10. **arietìna,** Anders. Stem 2–3 ft. high, hairy toward the top: lvs. 5–6 on a stem, rather glaucous and pubescent beneath; segments oblong to oblong-lanceolate, strongly confluent, decurrent: fls. always solitary, dark red, large: follicles 3–4, densely tomentose, ovoid, spreading widely, becoming 1 in. long, strongly arched; stigma recurved. Southern Europe. B.R. 10:819 (as *P. Cretica*).—There are a number of horticultural varieties. Eleven of these are: *Andersonii,* bright rose; *Baxteri,* crimson; *Crética,* blush-pink; *Crown Prince,* deep rich crimson; *Diogenes,* bright crimson; *Excelsior,* brilliant rose; *Matador,* pure rose; *Northern Glory,* large, soft rose-pink; *Penelope,* bright rose; *Purple Emperor,* crimson-purple; *Rosy Gem,* rose-pink.

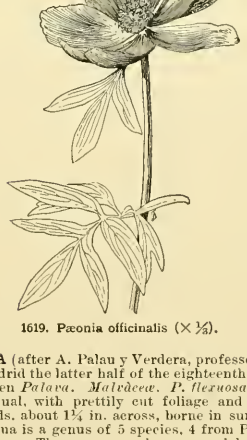
P. Brôteri, Boiss. & Reut. Fls. red, varying to white. Allied to P. officinalis and corallina in lvs. and habit.—*P. corallina,* Retz. Tall: lower lvs. only biternate: fls. crimson; petals rounded; follicles ornamental.—*P. coriàcea,* Boiss. Allied to P. albiflora: lfts. very broad: fls. bright crimson; stigma purple: follicles glabrous.—*P. Cýrica,* Sieber. Much like the preceding.—*P. Emòdi,* Wall. Closely related to and sometimes called a synonym of P. anomala. B.M. 5719. Gn. 45:946.—*P. húmilis,* Retz. Rather low: fls. bright red: carpels glabrous. B.M. 1422.—*P. microcárpa,* Boiss. & Reut. Allied to the preceding, but dwarfer. Var. Jonathan Gibson is a garden form, with very downy lvs.—*P. mòllis,* Anders. Low: fls. deep red and subsessile. L.B.C. 13:1263.—*P. oborâta,* Maxim. Lower lvs. not more than twice ternate: fls. large, red-purple: follicles glabrous.—*P. pùbens,* Sims. Allied to P. arietina: lvs. hairy below, margins red. B.M. 2264.—*P. Rossi,* Bivon. Allied to P. corallina, but with the lvs. decidedly hairy below.—*P. sessiliflòra,* Sims. Nearly related to P. mollis; very low: fls. subsessile, white.—*P. triternàta,* Pallas. Differs from P. corallina in its rounded lvs., green stem, and rose fls. B.M. 1441 (P. Daurica).—*P. Whitleyi,* Hort. Fls. single, white, large; should be considered as a variety of P. albiflora. Gn. 36:708.—*P. Wittmaniàna,* Stev. Beautiful pale yellow fls.: follicles glabrous. B.M. 6645.

K. C. Davis.

PAINTED CUP. *Castilleia.*

PAINTED LEAF. *Euphorbia heterophylla.*

PALAFÓXIA Hookeriana. See *Polypteris.*



1619. Pæonia officinalis (× ⅛).

PALAÙA (after A. Palau y Verdera, professor of botany at Madrid the latter half of the eighteenth century). Also written *Palava. Malvàceæ. P. flexuosa* is a half-hardy annual, with prettily cut foliage and 5-petaled pale rose fls. about 1¼ in. across, borne in summer and fall. Palaua is a genus of 5 species, 4 from Peru and 1 from Burma. They are annual or perennial herbs, tomentose or somewhat glabrous; lvs. usually lobed, dissected or sinuate; bractlets 0; fls. axillary, peduncled.

solitary; calyx 5-cut; ovary many-celled; style stigmatose at the apex; carpels crowded without order.

flexuòsa, Mast. Slender, branched from roots; stems 8–10 in. long, ascending, flexuous above; leaf-stalks 1–2 in. long; blades 1–2 in. long and broad, triangular in outline, pinnatifid, the segments lobed; lobes obtuse; fls. mauve, paler towards center, with bright red anthers which are very numerous and arranged in 5 longitudinal series; styles 25–30. Peru. B.M. 5768.

PALÀVA. See *Palaua*.

PALIÙRUS (ancient Greek name). *Rhamnàceæ*. Spiny trees or shrubs with alternate, 2-ranked, 3-nerved lvs., small greenish yellow fls. in axillary clusters and orbicular broadly winged, curiously shaped fruits resembling a head with a broad-brimmed hat. The one species cultivated in this country is not reliably hardy north of Washington, D. C.; in Mass. it is killed every winter almost to the ground even with protection, and the young shoots flower but bear no fruit. It is not very ornamental, but the dark green foliage is pretty and the curious fruits are interesting. It thrives in any well-drained soil and prefers a sunny and warm position. Prop. by seeds stratified or sown in autumn and by layers or root-cuttings. Four species from S. Europe to China and Japan. Stipules usually changed into spines: fls. small, perfect, in axillary or sometimes terminal cymes; petals 5, 2-lobed; stamens 5: fr. woody, 3-celled, depressed subglobose, with a broad, orbicular, horizontal wing; cells 1-seeded.

Spina-Christi, Mill. (*P. austràlis*, Gærtn. *P. aculeàtus*, Desf. *Zizyphus Paliùrus*, Willd. *Rhámnus Paliùrus*, Linn.). JERUSALEM THORN. CHRIST'S THORN. Spreading, spiny shrub to 10 ft., sometimes procumbent: 1 of the 2 spines at the base of the petioles straight, the other hooked and recurved: lvs. rather slender-petioled, ovate, usually unequal at the rounded base, obtuse, minutely serrulate, glabrous, dark green above, pale or grayish beneath, ¾–1½ in. long: fls. in axillary short-peduncled cymes: fr. brownish yellow, about ¾ in. across, glabrous, June, July. S. Eur. to Himal. and N. China. B.M. 1893 (as *Zizyphus Paliurus*) and 2535 (as *P. virgatus*).—This plant is supposed to have furnished the crown of thorns which was placed on the head of Christ before his crucifixion; others believe *Zizyphus Spina-Christi* to be the shrub the crown was made of. These two shrubs resemble each other so closely that they hardly can be distinguished without frs. which are berry-like in Zizyphus; the shape of the thorns is exactly the same in each species.

P. orientalis, Hemsl. Tree, to 30 ft.: lvs. 2–4 in. long, glabrous: fr. 1–1½ in. across, glabrous, purplish. China. This but recently introduced species is perhaps the most ornamental of the genus; it has not proved hardy at the Arnold Arboretum.—*P. ramosissimus*, Poir. (P. Aubletia, Kœm. & Schult.). Shrub similar to P. Spina-Christi, but with both spines straight, larger lvs. pubescent beneath, and smaller tomentose frs. China, Japan.

ALFRED REHDER.

PALM. Plate XXIV. Palms are amongst the most striking plants in tropical floras. Their tall, straight, unbranched trunks surmounted by a spreading canopy of huge pinnate or digitate foliage distinguish them from nearly all other forms of vegetation. They are widely spread in tropical regions, being most abundant in America and few in Africa. They are particularly conspicuous in the Pacific islands. Although the Palms are such bold and interesting plants, the species are very imperfectly understood. This is due to the great difficulty of making herbarium specimens, to the fact that the greater number of botanists are residents of regions in which Palms do not grow, and to the differences of opinion as to the relative importance of the various botanical characters. Many of the Palms have been named first from cultivated specimens, and often before the flowers and fruits are known. When the specimens finally come to fruit, the names are usually shifted, causing much confusion. The proper generic position of a Palm may be unknown for several years after it becomes popular in the horticultural trade. Consider the changes in nomenclature which have occurred in Palms that have been referred to the genera Areca and Kentia.

The species of Palms are not very numerous. They probably do not exceed 1,000, although more than that number have been described. Bentham & Hooker accept 132 genera, and Drude, in Engler & Prantl's "Pflanzenfamilien," accept 128 genera. Most of the genera are small, and many of them are monotypic. The largest genera are Calamus, with about 200 species, all Old World, mostly Asian; Geonoma, with about 100 species, all American; Bactris, about 100, American; Chamædorea, with about 60, all American; Licuala, with 30, ranging from eastern Asia to Australia; Desmoncus, about 25, American; Cocos, 30, all confined to America but the cocoanut, which is now cosmopolitan; Pinanga, with about 25 species, of the Oriental tropics; Areca, nearly two dozen, Oriental. Many of the species, particularly in the small genera, are restricted to very small geographical regions, often to one island or to a group of islands. The Palms represent an old type of vegetation, and they are now, no doubt, on the decline.

Palms have been favorite greenhouse subjects from the period of the first development of the glass planthouse. The stereotyped form of conservatory is a broad or nearly square structure, with narrow benches around the sides over the heating pipes and a Palm bed in the center. In these conservatories a variety of Palms will succeed, requiring neither a very high temperature nor much direct sunlight. In fact, Palms usually succeed best under shaded roofs. The Palms are most satisfactory in their young state, before the trunks become very prominent, and before the crowns reach the glass. The larger number of Palms have pinnate or pinnatisect leaves, and these species are usually the more graceful in habit. Small Palms are now in great demand for room and table decoration, and a few species are grown in enormous quantities for this trade. They are sold when small. They usually perish before they are large enough to be cumbersome. Amongst the most popular of these Palms are *Chrysalidocarpus lutescens*, *Howea Belmoreana* and *Forsteriana*, *Cocos Weddelliana*, *Livistona Chinensis*, and possibly one or two species of Phœnix.

Some Palms endure considerable frost without injury. Of such are the Sabals and the Palmettoes of the southern states. The Saw Palmetto (*Serenoa serrulata*) and the Blue Palmetto (*Rhapidophyllum Hystrix*) occur as far north as South Carolina. In Asia, Nannorhops grows naturally as far north as 34°, and in Europe, Chamærops (the only Palm indigenous to Europe) reaches 44°.

In the tropics, Palms furnish houses, clothing, food and ornaments. The range of the economic uses is well indicated by the following extract from Drude (in Engler & Prantl): "In a family which, like the Palms, is of such extraordinary importance in satisfying so many human wants, it seems well to make a few general remarks on this subject as an introduction to special remarks under the different genera. A European does well to distinguish between the products of the Palms which are imported from the tropics, and those which are used by the civilized peoples and more especially by the natives in the tropics. Of the first, there should be noted a few fruits, as, for example, dates and cocoanuts, whose use gives us a slight picture of the importance of Palm fruit of the tropics. Then follows the Indian sago coming from the pith of the stems, which surpasses in quality the European product, and then the oil made from fruits of oil Palms which, considering its almost unlimited supply, is of more importance than the olive oil. In Europe a great rôle is played by the fibers coming from many Palms, as the Piaçaba and Cocoa fibers. Perhaps, in the course of time, one or other of the Palm-leaf products will find greater use in the production of paper. The numerous kinds of 'Spanishschen Rohres,' that is, those thin stems of the genus Calamus which have a silicious covering, are necessary in the making of bent-wood furniture and baskets. Wax (from Copernicia, probably not from Ceroxylon) plays in Europe, as a competitor of beeswax, but a small rôle. On the other hand, the stone nuts, seeds of Phytelephas and the stony kernels of some Cocoineæ, are imported from America in ton quantities, to be used in making small articles. To these products, of considerable influence on the European trade, must be added numberless others used in the tropics, where the numerous

The wine palm, Jubæa spectabilis, in southern California

sweet as well as the starch-holding fruits are at the command of the inhabitants. From many species are cut out the soft terminal bud (heart), which is eaten as Palm salad, and from other very large species the young stems are cut off and the great quantity of sweet sap is worked to sugar, or arrac, or is used as Palm wine. Many stems furnish excellent building wood, and in the artistic industries of the Malays and Papuas as well as that of the natives of Brazil, such Palms furnish not only the main timbers of their huts, but the leaves are plaited and used for the sides and the roof. Other leaves cut in small strips give them coverings, mats, fans, shields, complete clothing and hats. Even the spines are used as tips for spears, for tattooing-paints and for hooks; whereas the fish-line itself is made of the strong fibers of other species. Other uses, as that of the betel nut (Areca), in chewing, are worthy of mention also."

1620. A Palm house

As the trunk of the Palm rises, the leaves underneath the crown die and fall. Usually the old petioles, or their bases, remain for some time, forming a shaggy capital to the column; this is well marked in the large or Cabbage Palmetto of the South. The Palms are mostly trees, and some of them rise to the height of nearly 200 ft., but some are climbing and others are low shrubs. In some species the stems are prickly. Usually they make very straight, comely boles, but a few species produce branches above. The flowers of Palms usually arise underneath or in the crown, from the axils of the leaves. The clusters are really spadices, although often branched, and are covered in the bud by a dry spathe composed of one or several leaves or parts. The remains of these spathes are well shown in Fig. 1497, p. 1100. In the upper cluster on the left the spathe is arching over the fruits. The blossoms are relatively small, and usually dull colored and not showy. The flowers are perfect or unisexual, 3-merous,—the segments usually 6 in two series, stamens usually 3 or 6, ovary usually 3-loculed or the 3 carpels wholly separate, stigmas 3 and usually sessile. The fruit is various, being either a drupe or hard berry-like structure, often edible.

The genera chiefly known to horticulturists are the following:

Tribe Areceæ. *Lvs. pinnatisect, the leaflets free or joined so as to form a plaited limb, the sides in vernation reduplicate: fls. monœcious or diœcious: seeds umbilicate, with ventral raphe and dorsal embryo.*

Areca, Pinanga, Kentia, Hydriastele, Kentiopsis, Hedyscepe, Nenga, Archonthophœnix, Rhopalostylis, Dictyosperma, Ptychosperma, Cyrtostachys, Drymophlœus, Cyphophœnix, Clinostigma, Cyphosperma, Euterpe, Acanthophœnix, Oreodoxa, Baeularia, Linospadix, Howea, Ceroxylon, Verschaffeltia, Dypsis, Chamædorea, Hyophorbe, Roscheria, Geonoma, Calyptrogyne, Wallichia, Didymosperma, Arenga, Caryota, Phytelephas.

Tribe Phœniceæ. *Lvs. pinnatisect, segments acuminate and with induplicate sides in vernation: spadices interfoliar, the spathe solitary: fls. diœcious: carpels 3, only one maturing, the stigma terminal: seed strongly ventrally sulcate, the embryo dorsal.*

Phœnix.

Tribe Corypheæ. *Lvs. fan-shaped, wedge-shaped or orbicular, plaited, more or less cut, the lobes with induplicate sides: spadices interfoliar, the spathes many: fls. usually perfect: ovary entire or 3-lobed, or sometimes the 1–3 carpels distinct, the ovule erect: pericarp usually smooth: seeds with ventral raphe and small hilum.*

Corypha, Sabal, Washingtonia, Chamærops, Rhapidophyllum, Acanthorhiza, Brahea, Erythea, Pritchardia, Licuala, Livistona, Trachycarpus, Rhapis, Thrinax.

Tribe Lepidocaryeæ. *Lvs. pinnatisect or fan-shaped, the segments with reduplicate sides in vernation: spadices terminal or axillary, the spathes numerous: fls. polygamo-monœcious: ovary entire, more or less 3-loculed: fr. clothed with reflexed, shining, imbricate, appressed scales: seed with dorsal raphe and ventral embryo.*

Calamus, Ceratolobus, Raphia.

Tribe Borasseæ. *Lvs. orbicular, the segments fan-shaped and the sides induplicate: spadices interfoliar, the spathes many and sheathing: fls. diœcious, the male minute and sunk in cavities on the spadix, the female very large: ovary entire, 3-loculed, the ovule ascending: fr. various.*

Borassus, Lodoicea, Latania, Hyphæne.

Tribe Cocoineæ. *Lvs. pinnatisect, the leaflets with reduplicate sides: spadices interfoliar, unisexual or androgynous, the spathes 2 or more: interior fls. often in 3's, the middle one female: ovary 1–7-loculed: fr. large, drupe-like, 1–7-loculed, the stigma terminal, the endocarp or shell hard and woody and provided with 3–7 pores.*

Bactris, Astrocaryum, Acrocomia, Martinezia, Elæis, Diplothemium, Cocos, Maximiliana, Scheelea, Attalea, Jubæa.

There is very little accessible monographic literature on the Palms. Martius' "Historia Naturalis Palmarum."

Munich, 3 vols., 1823–1850, is a standard work. Kerchove de Denterghem's "Les Palmiers," Paris, 1878, is an important work. A popular running account of Palms and the various kinds, by William Watson, will be found in the following places in Gardeners' Chronicle: 1884 (vol. 22), pp. 426, 522, 595, 728, 748; 1885 (vol. 23), pp. 338, 410, 439; 1885 (vol. 24), pp. 362, 394, 586, 748; 1886 (vol. 25), pp. 75, 557; 1886 (vol. 26), pp. 491, 652; 1887 (vol. 2, ser. 3), pp. 156, 304; 1891 (vol. 9), pp. 234, 298, 671; 1893 (vol. 13), pp. 260, 332. L. H. B.

HARDY PALMS IN CALIFORNIA.—Palms grown in the open in California gardens do not exceed in number 20 genera, and numbering about 60 species. The following 17 genera of about 40 species may be found in our best Palm collections, and all these species are growing in the gardens of Los Angeles and vicinity, and may be found throughout southern California in limited numbers from San Diego to Santa Barbara. Occasional plants of species not mentioned are found in some old gardens, but are not so plentiful as to be considered in a general list of our hardy Palms. In enumerating these plants they are placed as to their importance, or rather as to their numerical strength in California. Our native Fan-Palms, the Washingtonias, natives of San Bernardino and San Diego counties, have been most extensively planted, and may be found everywhere, serving, in some instances, a variety of purposes. Fig. 1622. In growing this Palm water is of the first importance. When planted along a street, those adjoining vacant lots often remain nearly at a standstill, except in case of an unusually wet winter, while those along the cultivated lots or lawns grow faster than any other Palm. When one in its native habitat blows over by the force of the desert winds, the hole left by the roots and stump invariably fills with water. Washingtonias are hardy 600 miles north of Los Angeles. It may be well to state that hardiness in Palms is principally a question of size, the larger ones passing through the most severe winter unharmed, while the small ones may perish. So, too, some Palms supposed to be very tender need protection from sun more than from frost. This is particularly the case with the so-called Kentias and Rhapis. A certain Howea (or *Kentia Forsteriana*) is protected only by a large overhanging branch of a sycamore, which is of course leafless in cold weather,

1621. Date Palms at Old Town, San Diego.

1622. A Sentinel Palm.
Washingtonia filifera, San Jacinto Mts., Cal.

yet it has reached a height of 12 feet, with a diameter at base of 12 inches, and it has never been injured by frost, yet water hydrants 10 feet away have been frozen so hard as to burst them. In Los Angeles is a Kentia 15 feet high, growing on the north side of a house, protected from sun alone, being 20 feet from the building, where for several winters the ground near by has frozen to the depth of 1 inch. This is in the bottom-lands, the coldest part of the city.

Phœnix dactylifera, though not so ornamental as others of the genus, was extensively planted in early days and is one of the hardiest of Palms. Fig. 1621. The most popular Palm for the masses, who look for grace and beauty combined with cheapness, is *Phœnix Canariensis*. More of these are planted at present than any other three species. In Los Angeles and vicinity they may be counted by tens of thousands. Like these two for hardiness is *P. reclinata;* and all may be seen growing north of San Francisco some 200 miles. All the genus is hardy in southern California. *Trachycarpus excelsus* and *Chamærops humilis*, the latter varying greatly in appearance, will grow as far north as any Palms and are popular everywhere. The former in thirty years will grow to the height of 25 feet, while the latter will make 8–10 feet of trunk in the same time. *Livistona australis* and *L. Chinensis* are both popular, though not hardy outside the southern part of the state, and the latter must be shaded from noonday sun. *Erythea armata* and *E. edulis* (often known as Braheas) grow around San Francisco bay luxuriantly. *Cocos eriospatha* is hardy even farther north than the Erytheas, and is by far the most ornamental Palm to be found in that section. Other Cocos in southern California are *C. flexuosa*, *plumosa*, *coronata*, *Romanzoffiana*, and many others. Any Cocos will grow here in protected places except Weddelliana. *C. plumosa* is without doubt the most graceful Palm grown, and at present very extensively planted in the southern citrous belt, sometimes for street or sidewalk trees. It is also one of the fastest growers, and will reach 20 feet in fif-

teen years, with ordinary care. *Archontophœnix Alexandræ* and *A. Cunninghamii*, the most elegant of our Palms after *Cocos plumosa*, are not quite so hardy but will thrive from Santa Barbara southward, in warm locations. The same exposures, with shade during the hottest part of the day, will do for *Hedyscepe Canterburyana* and *Howea Forsteriana* and *H. Belmoreana;* also *Rhopalostylis Baueri* and *R. sapida*. The four species of Sabals seem to thrive and seed well in this section, though *S. Palmetto* and *S. Blackburnianum* grow much faster than the others. *Rhapidophyllum Hystrix* is perfectly hardy, but on account of its dwarf habit is not so extensively planted as its merits deserve. *Rhapis flabelliformis* and *R. humilis* need protection from sun alone, though there is a Rhapis growing for ten years without protection from either sun or frost, and in the coldest section of Los Angeles, but its color is not all that could be desired. Chamœdoreas are planted only where they can be protected from both frost and sun, though they thrive better under such circumstances than they do under glass. In such situations they are just the plant for the purpose, as they do not grow away from the protecting tree as do sun- and light-loving Palms, but remain erect. *Brahea dulcis* may occasionally be seen but grows too slowly to be popular. One of our grandest and hardiest Palms, one that deserves for many reasons to be more extensively planted, is *Jubæa spectabilis*. We have a few 20 feet in height with a bole 4 feet in diameter, and are much more striking in appearance than any of the Phœnix, which latter they somewhat resemble.

ERNEST BRAUNTON.

The word Palm is a popular designation of one of the largest and most important families among the monocotyledons, about 1,200 species of Palms having been recorded, though many of these are not yet in cultivation. The members of this family are essentially tropical in habitat, are highly ornamental in appearance, and many of them also of very great economical value, their fruits, stems and leaves not only entering largely into the manufactured products of both Europe and America, but also providing both food and shelter for thousands of the inhabitants of tropical countries. One notable characteristic of Palms in general is their unbranched stems, the exceptions to this rule being very few, and mostly limited to the members of one genus, Hyphæne, of which the Doum Palm of Egypt, *H. Thebaica*, is the best example. While these unbranched stems form a prominent feature in connection with this order of plants, yet great variations are found in size and habit; some of them towering up like a slender marble shaft to a height of more than 100 feet and then terminating in a crown of magnificent plume-like leaves, while others may reach a height of only 3–4 feet when fully developed. In some instances the stems are so long and slender that a scandent habit is the result; these rope-like stems of the Rattan Palms in particular are described as wandering through the tops of some of the great trees of the Malayan Peninsula to a length of several hundred feet.

The foliage of the Palms is of two chief kinds, the fan-veined leaves, in which the venation radiates from a common center, and the feather-veined, in which the veins run out from the sides of a long midrib, the leaf being frequently divided into long, narrow segments. Of the first group the common Fan Palm, *Livistona Sinensis*, is a good example, while the Date Palm, *Phœnix dactylifera*, and also the Cocoanut, *Cocos nucifera*, are common examples of the feather-veined class.

There are also minor characteristics of foliage that mark many of the genera, some having pinnate leaves with erose tips, a few having bipinnate leaves (as *Caryota urens*), others with flabellate leaves having erose segments, and many with the segments of the leaves bifid or split at the tips.

The flowers of Palms in general are not specially attractive either in size or coloring, many of them being greenish white or yellow, and some orange or red; but these flowers are produced in prodigious quantities by some of the species, perhaps the most prolific in this respect being the Talipot Palm (*Corypha umbraculifera*), which throws up a branching inflorescence to a height of 30 ft. above the foliage, such an inflorescence having been estimated to include fully sixty millions of flowers!

The seeds of Palms are also found in many sizes and various shapes, ranging from the size of a pea in some of the Thrinax to the unwieldy fruits of the Double Cocoanut, *Lodoicea Seechellarum*, which will sometimes weigh 40 lbs. each and require several years to reach maturity.

As a rule, the members of any single genus of Palms are found in one hemisphere, either the eastern or western as the case may be, probably the greater number of species being of Asiatic origin, and comparatively few being found in Africa. An apparent exception is found to this system of hemispheric distribution in the case of the Cocoanut, this plant being so very widely distributed throughout the tropical world that its original habitat is still in doubt. On the other hand, some species are found to be very local in their natural state, in proof of which the Howeas may be cited; this genus has been found only within the circumscribed area of Lord Howe's Island, which from a comparative point of view may be termed merely a fragment of land

1623. A digitate-leaved Palm, and one of the best Palms for small conservatories—Rhapis flabelliformis.

(probably of volcanic origin), a mere dot on the broad bosom of the South Pacific.

Few Palms are found within the limits of the United States as natives, the most common being the well-known Palmetto, *Sabal Palmetto*, a member of the fan-leaved section, to which possibly all of our native Palms belong. But while the species of Palms found native in the United States are limited in numbers, yet there is at least one unique species in the group in the form of *Pseudophœnix Sargenti*, a monotypic Palm, that is only known to exist in a wild state on certain of the Florida Keys, and in quite limited numbers even there.

1624. Germination of Chrysalidocarpus lutescens.

Europe is even less favored as to native Palms, there being but one species known there in that condition, *Chamærops humilis*, also a fan-leaved species and comparatively hardy, being capable of enduring moderate frosts.

The Palm tree of the Bible is doubtless the Date Palm, *Phœnix dactylifera*, which is found in large numbers throughout Syria to this day; and in fact the small grove of dates within easy reach of the Syrian householder forms one of his most valuable assets, for it provides food not only for his family, but frequently for his horses or camels also.

The act of producing flowers does not necessarily terminate the life of a Palm, though in some instances such an effect may be produced by this cause; but a singular habit has been noted in regard to the flowering of the Fish-tail Palm, *Caryota urens*, which when it reaches maturity begins to throw out a flower-spike from the top of the stem, this being followed by successive spikes of flowers, and ultimate bunches of seeds from the top of the plant downwards, the flower-spikes appearing at the joints of the stem, and when this process of flowering has proceeded down to the ground, or until the vitality of the plant has been exhausted, death ensues.

There are also a number of species of Palms that develop a soboliferous habit, throwing up a number of shoots from the base of the plant, *Rhapis flabelliformis*, sometimes known as the Ground Rattan, being a good example of this class, among which the widely grown and elegant *Chrysalidocarpus lutescens* is also found, together with the Geonomas, some of the Phœnix and various other genera. Many of the Palms are unisexual, but there are also many others in which both male and female flowers are produced on the same spadix, in some instances the males being grouped together near the ends of the branches of the inflorescence and the females nearer to the main stem, while in others a female is placed between two males, thus arranging the flowers in threes.

Cross-pollination of Palms by artificial means has probably been seldom practiced, there being few cultivated collections in which the opportunity for such an operation has presented itself; but it seems highly probable that such cross-fertilization has been accidentally effected among wild plants, for in large lots of seedlings intermediate forms are frequently seen, this peculiarity having been noted among Howea seedlings, where forms intermediate between *H. Belmoreana* and *H. Forsteriana* are found, and sometimes seedlings that seem to combine the characteristics of *H. Belmoreana* and those of its near relative *Hedyscepe Canterburyana*. Similar variations from a given type have also been noted among the Phœnix, several so-called species being most likely merely varieties.

Many Palms are armed with stout thorns or prickles, not only the stems but also the leaves and even the fruits in some species being thus guarded, these prickles being usually very hard and tough. In some cases, notably *Acanthorhiza stauracantha*, the prickles around the stem are often branched, and are decidedly unpleasant to come in contact with. In the case of Desmoncus, this being the western representative of the Rattan Palms, the tip of the midrib of the leaf is continued in the form of a hooked spine, and helps to support the plant in its scandent career. The sharp spines of certain Palms are used for poisoned arrows by some of the South American tribes, these arrows being projected through a blow-pipe formed from a section of the hollow stem of another Palm. Among the species of Phœnix it is often found that several of the leaflets nearest to the base of the leaf are developed as spines, these thorny leaflets becoming stiff and hard, and capable of making a very sore wound.

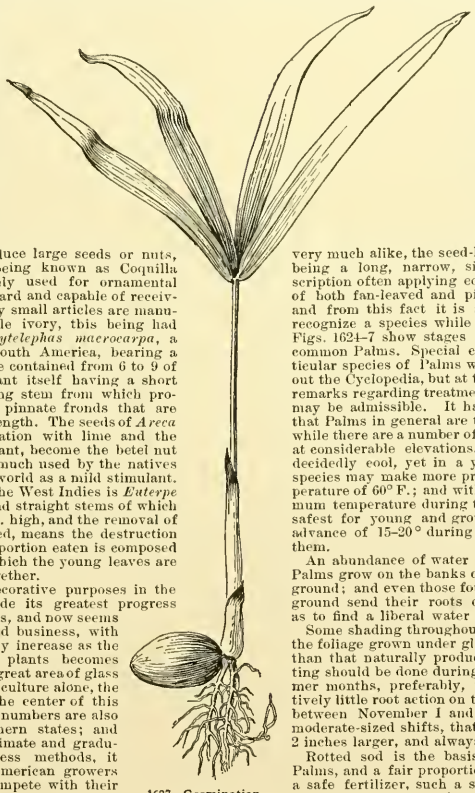
The very great economical value of many of the Palms can only be touched upon within the limits of the present article, the uses to which not only the fruits but also the stems and leaves are put by the natives of many tropical countries being enough of themselves to fill volumes. One prominent instance of this great utility is the Palmyra Palm, of which a Hindoo poet enumerated over 800 different uses. Other notable examples include the Cocoanut Palm, the fruits of which are imported by hundreds of tons every year, and in addition to providing a valuable food, either fresh or in a desiccated condition, also produce that very valuable fiber from which cordage, matting and a great variety of goods are manufactured. Also the Phœnix family, which produces the dates of commerce in apparently endless supply, and the date sugar of Bengal, this being contributed by *Phœnix sylvestris*, while the stems of Date Palms are often used in house-building in the East. Another very valuable Palm product is found in Palm oil, this being largely derived from the fruits of *Elaïs Guineensis*, the oil being expressed from the ripe fruits in much the same manner that olive oil is manufactured. The rattan of commerce is chiefly composed of the flexible stems of various calami, the plentiful supply of this material being sufficiently attested by the great variety of articles manufactured therefrom. Various Palms have been

1625. Livistona Chinensis.

1626. Germination of Cocos Weddelliana.

mentioned under the name of "Wine Palm," but it seems likely that some species of Raphia are most used for liquors, some portions of these Palms giving a large amount of sap when tapped, and as the juice is rich in sugar, the sap soon ferments and may become strongly alcoholic. The best sago is produced from the pith of Metroxylon or Sagus, the trees being cut down and split into segments for the removal of the pith, the latter being then prepared in a rough granulated form for export. Sago is also procured from Caryota and some other species, but the product is not equal to that of Metroxylon. The so-called whale-bone brooms frequently used in stables and for street-cleaning are mostly made from Piassaba (or Piaçaba) fiber, this being gathered from around the base of plants of Attaleas, mostly *A. funifera*. The Attaleas also produce large seeds or nuts, those of *A. funifera* being known as Coquilla nuts, and quite largely used for ornamental purposes, being very hard and capable of receiving a fine polish. Many small articles are manufactured from vegetable ivory, this being had from the nuts of *Phytelephas macrocarpa*, a singular Palm from South America, bearing a large fruit in which are contained from 6 to 9 of the ivory nuts, the plant itself having a short and sometimes creeping stem from which proceeds a noble head of pinnate fronds that are frequently 15–20 ft. in length. The seeds of *Areca Catechu*, after preparation with lime and the leaves of the pepper-plant, become the betel nut of the East Indies, so much used by the natives of that portion of the world as a mild stimulant. The Cabbage Palm of the West Indies is *Euterpe oleracea*, the smooth and straight stems of which are frequently 80–100 ft. high, and the removal of the "cabbage," so-called, means the destruction of such a tree, for the portion eaten is composed of the central bud in which the young leaves are compactly gathered together.

Palm culture, for decorative purposes in the United States, has made its greatest progress during the past 10 years, and now seems to be a well-established business, with the prospect of a steady increase as the adaptability of these plants becomes better understood. A great area of glass is now in use for Palm culture alone, the Middle States being the center of this industry, though large numbers are also grown in a few southern states; and owing to a favorable climate and gradually improving business methods, it seems probable that American growers will soon be able to compete with their more experienced brethren of Europe in this class of plants.



1627. Germination of Howea Belmoreana.

The species most used in commercial horticulture in the United States are contained in a very short list, the greater quantity being confined to five species, namely, *Livistona Chinensis*, *Howea Belmoreana*, *Howea Forsteriana*, *Chrysalidocarpus lutescens* and *Cocos Weddelliana*, while less quantities of *Caryota urens*, several species of Phœnix, *P. Canariensis* being quite largely planted outdoors in the South and on portions of the Pacific coast, *Seaforthia elegans* and some others of the Ptychosperma group, and some few Livistonas cover the extent of the catalogue for many growers.

Of these, the seeds are imported in a majority of cases, and on the quality of these seeds the success of the grower depends, so far as getting up a stock is concerned. Most of these species germinate readily in a warm greenhouse, providing the seeds are fresh, the slowest of the common commercial Palms being the Howeas. In small quantities these seeds are usually sown in about 6-inch pots, the pots being well drained and nearly filled with light soil, then the seeds sown thickly and covered with half an inch of soil, watered thoroughly and placed where they may receive the benefit of some bottom heat, and at no time should they be allowed to become very dry. The period required for germination varies greatly with different species, *Livistona Chinensis* germinating in 2 or 3 weeks if fresh, and being ready for potting in about 2 months, while seeds of some of the Attaleas have been known to remain in the earth for fully 3 years before starting.

The seedlings of many species are very much alike, the seed-leaf in many instances being a long, narrow, simple leaflet, this description often applying equally to the seedlings of both fan-leaved and pinnate-leaved species; and from this fact it is somewhat difficult to recognize a species while in the juvenile form. Figs. 1624–7 show stages in the germination of common Palms. Special cultural notes for particular species of Palms will be found throughout the Cyclopedia, but at this time a few general remarks regarding treatment of Palms as a whole may be admissible. It has already been noted that Palms in general are tropical in nature, and while there are a number of species that are found at considerable elevations, where the nights are decidedly cool, yet in a young state the same species may make more progress in a night temperature of 60° F.; and with this in view, a minimum temperature during the winter of 56–60° is safest for young and growing Palms, while an advance of 15–20° during the day will not hurt them.

An abundance of water is required, for many Palms grow on the banks of rivers or in swampy ground; and even those found on high and rocky ground send their roots down to such a depth as to find a liberal water supply.

Some shading throughout the summer is best, the foliage grown under glass being more tender than that naturally produced outdoors. Repotting should be done during the spring and summer months, preferably, there being comparatively little root action on the part of most Palms between November 1 and March 1. Give only moderate-sized shifts, that is, use pots only 1 or 2 inches larger, and always ram the soil firmly.

Rotted sod is the basis for the best soil for Palms, and a fair proportion of stable manure is a safe fertilizer, such a soil being mixed with various proportions of peat or sand, to make it lighter and more open for some delicate species.

Insects are frequently troublesome if allowed to gain headway, various scale insects doing the greatest damage, while red spiders and thrips may become established unless forcible syringing is persisted in. The most successful practice requires close observation on the part of the grower, and the prompt removal of all insects

W. H. TAPLIN.

PALMA Christi is Castor Oil Plant, *Ricinus*.

PALMERÉLLA (Dr. Edward Palmer, contemporaneous American botanical collector). *Lobeliàceæ*. A genus of one species, a rare herb found in Lower Calif., with small blue fls. like those of a Lobelia. The genus differs from Lobelia in the remarkable adnation of the stamens, as well as in the integrity of the corolla-tube,

at least its upper part. It soon splits from the base upward for a good distance, and, indeed, before withering the lower part of the corolla is much disposed to separate into five claws (liberating also the lower part of the filaments). The filaments are adnate to the corolla-tube for a long distance and then monadelphous and adnate on one side or the other.

débilis, Gray. Slender, glabrous, branching herb: lvs. alternate, linear-lanceolate, entire, sessile, 2–3 in. long; floral ones gradually reduced to bracts: raceme lax, few-fld.: corolla-tube whitish, 9 lines long, lobes light blue, 2 of them smaller than the others, the larger ones 3–4 lines long. Var. **serràta**, Gray, was offered in 1881 by E. Gillett, but it is probably not in cult. anywhere.

PALMETTO. See *Sabal*.

PALMS, POPULAR NAMES OF. **Alexandra P.,** *Archontophœnix Alexandræ*. **Assai P.,** *Euterpe edulis*. **Betel-nut P.,** *Areca Catechu*. **Blue P.,** *Erythea armata*. **Bourbon P.,** *Latania*. **Broom P.,** *Attalea funifera* and *Thrinax argentea*. **Cabbage P.,** *Euterpe oleracea*. **Club P.,** *Cordyline*. **Cocoanut P.,** *Cocos nucifera;* Double Cocoanut or Sea Cocoanut P., Lodoicea. **Coquito P.,** *Jubæa spectabilis*. **Corojo P.,** *Acrocomia sclerocarpa*. **Curly P.,** *Howea Belmoreana*. **Date P.,** *Phœnix dactylifera*. **European P.,** *Chamærops humilis*. **Fan P.,** any species with tan-shaped, rather than pinnate lvs. **Fern P.,** *Cycas*. **Fish-tail P.,** *Caryota urens*. **Flat P.,** *Howea Forsteriana*. **Guadeloupe P.,** *Erythea edulis*. **Gru-gru P.,** *Astrocaryum vulgare* and *Acrocomia sclerocarpa*. **Hemp P.,** *Chamærops excelsa*. **Ivory-nut P.,** *Phytelephas macrocarpa*. **Norfolk Island P.,** *Rhopalostylis Baueri*. **Oil P.,** *Elæis Guineensis;* also *Cocos butyracea*, etc. **Palmetto P.,** *Sabal*. **Panama-hat P.,** *Carludovica palmata*. **Para P.,** *Euterpe edulis*. **Raffia P.,** *Raphia*. **Royal P.,** *Oreodoxa regia*. **Sago P.,** various species of *Sagus* and *Cycas*. **Savanah P.,** *Sabal mauritiæformis*. **Talipot P.,** *Corypha umbraculifera*. **Thatch P.,** *Sabal Blackburniana; Howea Forsteriana*. **Toddy P.,** *Caryota urens*. **Umbrella P.,** *Hedyscepe Canterburyana*. **Walking-stick P.,** *Bactaris monostachya*. **Wine P.** of E. Indies, *Caryota urens, Phœnix sylvestris* and *Borassus flabelliformis;* of New Granada, *Cocos butyracea*.

PALUMBÌNA (said to be from *palumbes*, wood-pigeon; from a supposed resemblance of the fls.). *Orchidàceæ*. A monotypic genus greatly resembling Oncidium, with which it was formerly united. It differs principally in having the lateral sepals entirely united, forming a single segment resembling the dorsal sepal in shape and size, the labellum scarcely larger than the petals and resembling them in shape.

cándida, Reichb. f. The only species is a small plant with narrow, compressed pseudobulbs, each with a single slender leaf, 6–12 in. long: fls. few, small, white, in a slender raceme; sepals, petals and labellum oblong, acute, differing but little in size and shape. Guatemala. B.M. 5546. G. C. 1865:793; II. 20:233 (as *Oncidium candidum*).—May be easily grown in a temperate house. Blooms in summer, the fls. lasting a long time. HEINRICH HASSELBRING.

PAMPAS GRASS. See *Gynerium*.

PÀNAX (old Greek name, meaning *all-healing*). *Araliàceæ*. Thirty to 40 trees or shrubs, mostly of the tropics of Asia, Africa, Australia and the Pacific islands, as defined by Bentham & Hooker (including Nothopanax), some of which are grown in warmhouses for their interesting habit and foliage. The genus is confused in gardens with Aralia, Acanthopanax, Fatsia, Eleutherococcus, Polyscias, and others. From the Aralia group it is distinguished by having the petals valvate (applied edge-to-edge) in the bud. From Polyscias, Pseudopanax and Eleutherococcus it is known by its gynœcium (or pistils) being usually in 2's, rather than in 5's or higher numbers. From Fatsia it is distinguished by having the pedicel articulated beneath the flower. See *Fatsia* for another discussion of relationships. Panax has a calyx with entire or 5-toothed margin, 5 valvate petals, 5 stamens with oblong or ovate anthers, usually 2-loculed ovary which ripens into a drupe-like compressed fruit, and with mostly compound, often much-divided leaves: fls. small, sometimes polygamous, in umbels, heads, racemes or panicles. The Panaxes are to be grown in the warmhouse, where they should have the treatment given tropical Aralias (see p. 87).

As defined by others, the genus Panax includes only 7 or 8 herbaceous species, natives of the temperate regions of North America and Asia, while the woody species are referred mostly to Polyscias and Nothopanax; the species of the Polyscias have, according to Harms, pinnate leaves, and those of the other have digitate or simple leaves. As thus understood, the genus Panax includes the ginseng, *P. quinquefolium*, for which see *Ginseng*. The dwarf ginseng or ground-nut of the northern states is *P. trifolium*. It is not in the trade. These two plants are often described in the genus Aralia as *A. quinquefolia* and *A. trifolia*.

fruticòsum, Linn. (*Nothopànax fruticòsum*, Miq. *Polyscias fruticòsa*, Harms). Shrub 3–6 ft. in cult., with pinnately compound lvs., the lfts. stalked, ovate-oblong, acuminate, coarsely serrate, the ultimate ones incised, 3-lobed: fls. in paniculate umbels. Java, etc.—Prized for its fern-like foliage, but known mostly in its cultivated varieties.

Var. **Victòriæ** (*P. Victòriæ*, Hort.). Fig. 1628. A compact form which constantly sends up new stalks: foliage recurving, cut, curled and tasselled, light green, with white-variegated margins. G.C. II. 19: 405. I.H. 31:521. An excellent table plant. Through inadvertence, Fig. 1628 was used in the place of *Aralia Guilfoylei*, p. 87, 1st ed.

1628. Panax fruticosum, var. Victoriæ.

Var. **laciniàtum** (*P. laciniàtum*, Hort.). Lvs. twice-pinnate, drooping, about as broad as long, tinted with olive-brown, the leaflets and divisions narrow. Very graceful.

Var. **excélsum** (*P. excélsum*, Hort. †). Lvs. very finely cut and fern-like, margined with white.

Var. **plumàtum** (*P. plumàtum*, Hort.). More finely cut than var. *laciniatum*, and differing from var. *excelsum* in having no white on the foliage.

lépidum, Bull. Compact: lvs. biternately divided, the end division largest; pinnules or ultimate leaflets obliquely obovate, the central one in each case small (sometimes almost rudimentary) and more or less covered by its two lateral ones, the margins spiny-toothed and cut. Brazil. Recent.

nítidum, Bull. Compact: lvs. roundish obovate, toothed and somewhat spiny, sometimes with deep incisions. Brazil. Recent.

aùreum, Sander. "A distinct elegant and highly attractive Panax, the whole leafage being suffused with a delicate golden green variegation. The habit is similar to that of *P. Victoriæ*, quite as compact and bushy, but not heavy in the slightest sense of the word. Individually the leaves are small, the edges finely serrated, while near the margins are several splashes of clear green."—*Sander*.

Bálfourii, Sander. "A decided acquisition for all decorative requirements, strikingly and profusely variegated. Its luxuriant pinnate leafage renders its deep green and creamy white coloring the more attractive. Each of the pinnæ forming the leaf is orbicular in outline and deeply serrated, of a rich ivy green, abundantly splashed with creamy white, the edges of the leaves being entirely white. The stems are bronze-green, speeked with gray. The habit is compact and bushy, well feathered from base to apex with foliage. Introduced by us through our collector, Micholitz, from New Caledonia."—*Sander*.

Plate XXIV. Palms

Center, Palmetto, on the Indian River, Florida. The others are from Los Angeles: upper left-hand corner, *Erythea edulis*, in fruit; lower left-hand, *Chamærops humilis*; top center, *Trachycarpus excelsus*, 30 years old; upper right, *Livistona Chinensis*; lower right, *Howea Belmoreana*

The above comprise all the Panaxes known to have been offered in the American trade, but there are many novelties in Old World collections, which may appear here at any time. The garden plants are often named before they have bloomed, and are therefore sometimes referred to the wrong genus. Some of the names are here given: *P. crispàtum*, Bull. Dw rf: lvs. triangular, pinnate, the lfts. deeply incised and toothed, the lateral ones overlapping. Brazil.—*P. Deleauànum*, Hort., is properly P. fruticosum, var. Deleauanum, N. E. Brown. A remarkable variation with digitate lvs., the divisions ternate or 2-ternate, the ultimate segments variable, but cuneate at base, toothed and cut and white-toothed. Polynesia, I H. 30:192. Known also as Aralia Deleauana.—*P. diffùsum*, Bull. Form of P. fruticosum, with bright green, crisped lfts., which are linear-oblong and spiny-toothed. Polynesia.—*P. dissèctum*, Bull. Erect, branching, the 2-pinnate lvs. drooping, the lfts. cuneate-obovate and toothed and often 2-lobed.—*P. dumòsum*, Bull. Short-stemmed: lvs. roundish ovate, pinnately divided, the variable ultimate divisions spine-toothed.—*P. fissum*, Bull. Stem marked with pallid spots: lvs. 3-pinnate, the lfts. linear-lanceolate and whitish toothed. Polynesia.—*P. Mastersiànum*, Sander. Of climbing habit, with long-stalked drooping pinnate lvs. about 3 ft. long, the petiole greenish, tinged with pink and marked with white, the lfts. oblong-lanceolate and toothed. Solomon islands. G.C. III. 25:245.—*P. multifidum*, Hort., is properly P. fruticosum, var. multifidum, N. E. Brown. Compact plant, with 3-pinnatisect lvs. and linear or linear-lanceolate segments ½ in. or less long, with bristly teeth.—*P. Murrayi*, Muell. (Aralia splendidissima, Hort.). Tree in its native place, with drooping, shining green pinnate lvs. 3–4 ft. long, and many oblong-lanceolate lfts. 3–6 in. long: umbels of brownish fls. in long, terminal panicles. S. Sea islands, Austral. B.M. 6798.—*P. ornàtum*, Bull. Lvs. long, pinnate, the lfts. narrow-lanceolate and deeply blunt-toothed. Brazil.—*P. sessiliflòrum*, Rupr. & Max., is described in Acanthopanax, its proper genus.

L. H. B.

PANCRÀTIUM (Latin, *all-powerful;* referring to supposed medicinal value). *Amaryllidàceæ*. Pancratiums and Hymenocallis, sometimes called Spider Lilies or Spirit Lilies, form a beautiful group of bulbs, hardy or tender, some blooming in winter, others in summer, and all characterized by the singular and beautiful floral structure known as a staminal cup and pictured in Vol. II at page 788. This cup is white and has the texture of petals. It is fringed or toothed in a great variety of ways. The filaments growing out of the cup are long or short. The perianth segments are generally long, slender and gracefully recurved. Thus many fanciful variations of the Spider Lily type are produced.

The names of these charming plants have been shifted back and forth between Pancratiums and Hymenocallis until horticulturists have come to despair. The latest monographer of the Amaryllis family (J. G. Baker, in Handbook of the Amaryllideæ, 1888), distinguishes the two genera as follows: Pancratium has many ovules in a cell and the seeds are black and angled by pressure; Hymenocallis has few ovules in a cell, and the seeds are usually solitary, large, and with a thick, green, spongy coat. Pancratium is an Old World genus: Hymenocallis is a New World genus, *H. Senegambica*, an African species, being an exception.

For generic description and culture, see *Hymenocallis*. Also notes by Miss L. Greenlee in Vick's Mag. 20:181, where, however, the picture labeled *P. ornatum* probably represents *P. ovatum*, which is *Hymenocallis ovata*.

A. *Perianth-tube 1–3 in. long.*

B. *Staminal cup small, 3–4 lines long.*

Illýricum, Linn. Fig. 1629. Lvs. 5–6, strap-shaped, glaucous, 1½–2 in. wide: scape 1 ft. or more long: fls. 6–12 in a centripetal umbel; perianth-tube 1 in. long; segments 1½ in. long; staminal cup with long, narrow, 2-cut teeth; free portion of filaments 6–9 lines long: seeds not compressed. Summer. Corsica, Sardinia, Malta, S. Italy. B.M. 718. Gn. 48, p. 246.—Hardiest, commonest and best.

BB. *Staminal cup large, 1 in. long.*

maritimum, Linn. Fig. 1629. Lvs. 5–6, linear, glaucous, persistent, finally 2–2½ ft. long; fls. very fragrant; perianth-tube 2–3 in. long; staminal cup very prominent, the teeth short, triangular and regular; free part of filaments 3 lines long. Spain to Syria. B.R. 2:161.

AA. *Perianth-tube 5–6 in. long.*

tortuòsum, Herb. Same section as *P. verecundum*, shown in Fig. 1629, but not in the trade. Lvs. 6–12, linear, spirally twisted; fls. 2–4 in an umbel; staminal cup over 1 in. long, distinctly toothed between the short free tips of the filaments. Autumn and winter. Arabia and Egypt.

1629. Pancratium: types of three sections of.

At the right, the short perianth-tube and small staminal cup of *P. Illyricum*. At the left, the relatively short tube and large cup of *P. maritimum*. At the top, the long tube and small cup of *P. verecundum*, to which *P. tortuosum* is very closely allied. (From B.M. and B.R.)

P. Amáncæs, Ker.=Hymenocallis Amancæs.—*P. amœnum*, Andr.=H. ovata.—*P. calathìnum*, Ker.=H. calathina.—*P. Caribæum*, Linn.=H. Caribæa.—*P. coronàrium*, Le Conte=H. crassifolia.—*P. floribùndum*, Hort. Saul, 1893, is not accounted for by Baker.—*P. frágrans*, Salisb.=H. ovata, but P. fragrans, Willd.=H. Caribæa.—*P. Galvestonènse*, Hort., presumably=H. Galvestonensis.—*P. Harrisii*, Hort., is presumably H. Harrisiana.—*P. littorále*, Jacq.=H. littoralis.—*P. Mexicanum*=H. lacera.—*P. ovàtum*, Mill.=H. ovata.—*P. rotàtum*, Ker.=H. lacera.—*P. undulatum*, HBK.=H. undulata.

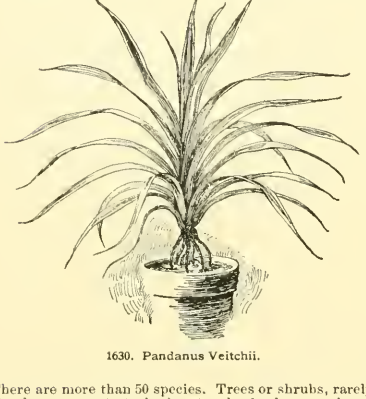
W. M.

PANDÁNUS (Latinized Malayan name). *Pandanàceæ*. Screw Pine. Screw Pines are tropical plants often attaining the size of trees, and remarkable for their stilt-like aërial roots, and the perfect spiral arrangement of their long, sword-shaped lvs. Their general appearance is singular. See Fig. 1633. They hold aloft a few long, scarred, naked branches, each one of which is crowned by a tuft of lvs. The aërial roots gradually lift the trunks out of the ground, but they doubtless anchor the trees also. They are, however, difficult organs to explain. Pandanuses are also remarkable for their spines, which are rather small but very numerous, all the same size and arranged at regular intervals along the whole of each gracefully recurved sword-shaped leaf—a perfect expression of formal linear beauty.

Two species of Pandanus are of the first importance, *P. Veitchii* and *P. utilis*, the former variegated, the latter not. (See Figs. 1630–32.) Young plants of these are amongst the most popular of all foliage plants for home decoration. They are especially suited for fern pans and table decoration. They are grown to a very large extent by wholesale florists and palm specialists. Every conservatory has them, and occasionally *P. utilis* is

grown to a considerable age and height for the sake of a perfect specimen of the spiral habit of growth on a large scale. See Fig. 1631. In the tropics *P. utilis* is as valuable to the natives as many palms. The fruits are edible, and the roots furnish fiber for ropes, baskets, mats and hats, as do also the leaves, which are used in making paper and nets. In Mauritius the leaves of *P. odoratissimus* are used to make the bags in which coffee, sugar and grain are exported.

Screw Pines are widely distributed in the tropics, but they are most plentiful in the Malay Archipelago.



1630. Pandanus Veitchii.

There are more than 50 species. Trees or shrubs, rarely stemless or prostrate herbs: trunk slender or robust: lvs. very long or moderately so. There is only one other genus in the order,—Freycinetia. This has numerous ovules in the locules, while those of Pandanus are solitary in the carpels. Also Freycinetias are usually scandent.

The botany of Pandanus is almost hopeless. Pandanus presents an acute example of the stock difficulties with foliage plants: flowers and fruits rarely produced in cultivation; no monograph; original descriptions scattered through many rare and costly books, and often faulty; geographical distribution too wide ever to permit them to be accounted for in one flora; fls. and fr. too complicated and out of the ordinary to describe within reasonable limits; species coming and going; mixtures in the trade. Even the standard botanical works are of little help to the horticulturist, for the two points of view have scarcely anything in common. But Pandanus has peculiar difficulties, for the plants are dioecious, and one never knows what the sex will be until the plants flower. There is a good horticultural review of Pandanus in Gn. 25, p. 134 (1884), but the best account is that written by W. H. Taplin for the Florists' Review 2:387, which has been revised for the present occasion by Mr. Taplin. W. M.

In general, the species of Pandanus are not difficult to manage and under favorable conditions they are rapid growers. They require a high temperature, 65–70°, and little or no shading during the winter months, especially for the variegated kinds. A satisfactory soil is good loam enriched with old manure. As the plants make many coarse roots, it is best not to pot them too firmly, and during the summer to give them abundance of water. If the atmosphere is moist there is little need for syringing overhead, and particularly during winter. Overwatering, if coupled with an accidental low temperature, may lead to an attack of "spot."

Certain species, as *P. Veitchii*, produce suckers freely. Cuttings of these root easily at any season. Rooting is hastened (as in the case of the pine-apple) by keeping the cuttings somewhat on the dry side until they are callused, meanwhile giving them a fair amount of bottom heat.

P. utilis is propagated by seeds, which are a regular commodity and sure to germinate well. Seeds should be planted in light soil and placed in a warmhouse. The seeds should be set "bottom up," as this is the end from which the germs emerge. The seeds are odd-looking, being closely set in a more or less globular mass that hangs down on a stout stem, while the individual seeds, or rather fruits, are compound and often contain 8 or 10 germs, the latter being inclosed in cells of a tough, horny substance within the body of the fruit. Some gardeners soak the seeds before planting, but the writer has found no gain after soaking seeds of *P. utilis* for 48 hours in tepid water.

P. Veitchii is one of the very best variegated plants for decorative purposes. Its endurance as a house plant depends largely on the conditions under which it has been grown. Soft and sappy specimens are liable to rot.

P. utilis is second in importance in the trade, but is usually obtainable in much larger quantities owing to the readiness with which the seeds may be obtained and germinated. Plants in 3-inch pots, 8 inches high, retail at about 25 cents; plants in 6-inch pots, 18 inches high, about $1. Handsome specimens 3 feet or more high, with the screw character well developed, are worth from $5 to $10. *P. utilis* is a rapid grower and requires generous treatment as regards soil and water, and gives little trouble unless spot develops. The spot is caused by the burrowing of a minute insect in the leaf. Its progress seems to be favored by overwatering. Badly affected plants should be thrown away, as they are likely to be permanently disfigured. In case of a light attack, keep the plants somewhat drier and dose them with sulfur.

Among variegated kinds *P. Candelabrum*, var. *variegatus*, is perhaps second in beauty only to *P. Veitchii*, but, unfortunately, it is too spiny and the spines on the lower side are reversed, so that the plant is difficult to handle. It suckers freely.

Among dwarf kinds *P. graminifolius* excels. It is only 2–3 ft. high when fully developed, and it is at its best in a 4- or 5-inch pot. It is suitable for the center of fern pans and is readily increased by cuttings.

For large specimens *P. heterocarpus* is a noble plant. It is rather susceptible to overwatering in winter. The writer has never seen it produce suckers. The same is true of *P. Vandermeeschii*. Theoretically, any Pandanus will produce suckers if one has the patience to wait for them to develop on old specimens, or if the central growth be cut out.

Among the more spiny kinds *P. reflexus* is unique in habit, the leaves of a well-grown plant being so much recurved as to hide the pot.

P. Baptistii and *P. caricosus* are newer sorts. The former is variegated. *P. caricosus* is dwarfer than *P. Baptistii*, and has narrow, green leaves but little armed with spines. It branches freely and might be briefly described as a very strong *P. graminifolius*, though perhaps less useful for trade purposes.

W. H. Taplin.

Pandanus Sanderi, or as it has been termed the "Golden Pandanus," will not only become a great rival to the popular *Pandanus Veitchii*, but will, as soon as it is introduced and can be produced in quantity, outrank it as a commercial plant on account of its more decided, intense and attractive markings. The variegation of *P. Sanderi* is of a pleasing creamy yellow, distributed in some instances with alternate bands of green, while in others the half of an entire leaf will be marked with this creamy yellow variegation, while the young growth in the center assumes an orange bronze color. The entire plant is suffused with a golden sheen in a manner difficult to describe.

The variegation throughout the plant is more decided than in *P. Veitchii;* this especially appears to be the case in larger-sized specimens, say in plants 3 to 4 feet high, where the lower or older leaves attain a much more brilliant color, while in *P. Veitchii* this lower foliage loses much of its original brightness, and under ordinary circumstances frequently turns entirely green.

The growth of the plant also appears more graceful, the leaves being recurved in a more pleasing manner, and suckers very freely. J. D. EISELE.

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CC. *Habit of lvs. more or less recurved* ..... 14. **Candelabrum**
CCC. *Habit of lvs. stiff, nearly erect* ..... 15. **Vandermeeschii**

1. **Veitchii**, Hort. · Fig. 1630. Lvs. 2 ft. long, broader than in *P. utilis*, somewhat recurved, spiny, dark green in the center, margined with broad bands of white. Polynesia. A.F. 4:570. F. 1871, p. 177. Gn. 2, p. 501.

2. **Candelàbrum**, var. **variegàtus**, Hort. (*P. Javánicus*, var. *variegàtus*, Hort.). Lvs. 3–6 ft. or more long, margined white; marginal spines white; spines on the midrib of the lower surface reversed. Java. F.R. 2:389. V. 9:20. Lowe 36.—Perhaps ranks second in beauty only to *P. Veitchii*, but unfortunately it is too spiny. Lvs. drooping, narrower than in *P. Veitchii*. See No. 14.

3. **Báptistii**, Hort., offered by Saul and Pitcher & Manda; has a yellow stripe down the center. Taplin says it is a rapid grower. Not in Index Kewensis.

4. **Sánderi**, Hort. Sander. Habit tufted: lvs. 30 in. long, with minute marginal spines, not unlike those of *P. Veitchii* but of denser habit, and differing much in the variegation, which in this case is golden yellow, and in place of being confined to the margin, or nearly so, it is distributed in narrow bands of yellow and green in alternation throughout the length of its leaf. G.C. III. 23:249. R.H. 1898, p. 230. G.M. 41:686. A.G. 19:455.—Taplin says it is a rapid grower.

5. **ùtilis**, Bory. Figs. 1631–3. Attains 60 feet in Madagascar: lvs. glaucous, erect, 1–2¾ ft. long, spines red. Madagascar. Here may belong I. H. 7:265 (*P. mauritianus*); B.M. 5014 (*P. Candelabrum*); R.H. 1866:270 (*P. flagelliformis*, or *flabelliformis*). A.F. 4:571.—Nicholson refers *P. odoratissimus* to *P. utilis*.

6. **Fórsteri**, Moore (*P. Fosteridnus*, Hort. Siebrecht). Lord Howe's Island. Better accounted for in Voss' scheme on next page.

7. **pygmæus**, Thore. Low, spreading shrub, not over 2 ft. high in the center, but sending out from the base numerous horizontal, rooting, annulated branches: lvs. about 4 ft. long, spirally arranged in 3's, linear-subulate, with a clasping base; margins and keels fringed with small white spines. Mascarenes. The above description taken from B.M. 4736, which is a doubtful specimen.

8. **graminifólius**, Kurz. Lvs. 12–18 in. long by 3–4 lines wide; marginal spines minute, straight. Burma. *P. graminifolius* of the trade has never been carefully distinguished from *P. pygmæus*, and, according to Nicholson, it is a species of Freycinetia. F.R. 2:388, where Taplin says it has a tufted, much-branched habit, dark green lvs. about ½ in. wide, not so stiff as most species; spines short, whitish.

9. **furcàtus**, Roxb. Tree, attaining 30–40 ft.: lvs. 15–20 ft. long, somewhat glaucous beneath; spines 1–2 lines long, curved. India. R.H. 1879:290; 1881, pp. 174, 175.

10. **heterocárpus**, Balf. f. Branching tree, with slender trunk, very numerous roots and spreading branches: lvs. lanceolate-acuminate, dilated and clasping at the base, erect-spreading, leathery, strict, greenish, often somewhat glaucous at the base, rather flat margin covered with small red, slightly incurved spines; lower midrib furnished from the middle with distant spines of the same character. Mascarene Islands.—A very variable species, approaching *P. utilis*, but distinguished by habit. Taplin says that *P. ornatus* of the trade is synonymous with *P. heterocarpus*: "Strong-growing, with broad, dark green foliage; spines white; under side of lvs. slightly glaucous."

11. **caricósus**, Spreng. Shrub: lvs. 5–8 ft. by 2–2½ in., slightly glaucous; spines minute, white, relatively few: male inflorescence erect. Moluccas. R.H. 1878, p. 405. —Offered by Van Geert, of Belgium.

12. **odoratíssimus**, Linn. f. Height 20 ft.: lvs. light green, 3–5 ft. long; spines short, white. India, Arabia. G.C. III. 17:14.—A scent which is much esteemed in Java is obtained from the male fls. The above description is from Nicholson. The species is not satisfactorily accounted for in the Flora of British India. Var. **variegàtus**, Hort., secured by Reasoner from the West Indies, is identical with what the florists call *P. Javanicus*.

13. **reflèxus**, Lodd. Lvs. more completely recurved than in other common species, 5–6 ft. long, dark green, shining; spines long, white, those on the midrib of the lower side reversed. Mascarene Islands. F.R. 2:387. —Adv. 1895 by Pitcher & Manda.

1631. Pandanus utilis.

A young Screw Pine just beginning to show the spiral character.

14. **Candelàbrum**, Beauv. CANDELABRUM TREE. CHANDELIER TREE. Tree, attaining 30 ft. "Lvs. 3 ft. by 2 in., dark green; spines brown" (Nicholson). Trop. Africa. B.M. 5014 is doubtful, referred to *P. utilis*.—Not

advertised in Amer., but for the popular variegated form, see No. 2.

15. **Vandermeeschii,** Balf. f. Lvs. stiff, suberect, 2½–3 ft. long, 1½–2 in. broad, very glaucous; margins red and thickened; spines strong, red; midrib red, prominent, spiny. Attains 20 ft. in Mascarenes. G.C. III. 18:237.—Taplin says it is stouter and usually more upright than *P. Veitchii;* its lvs. are dark green and the plant does not produce suckers. The spelling Vandermeerschii is probably incorrect.

ANOTHER VIEW OF PANDANUS.

In the third edition of Vilmorin's Blumengärtnerei, Voss gives a very different treatment of Pandanus. It has every evidence of being based upon living plants in German conservatories. A portion of it is here translated and rearranged. Voss makes the species-endings feminine because of the old Latin rule about the gender of trees.

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A. *Young plants with unbranched stems.*

B. *Upper side of lvs. flat on each half.*

1. **útilis,** Linn. (*P. odoratissima*, Jaeq.). Margin of lvs. purplish red, strongly spiny: lower side of lvs. with a keel. Var. **Madagascariénsis,** Van Houtte (*P. Vandermeeschii*, Balf.). Lvs. thickly white-powdered at the base. *P. Forsteri*, Moore, from Lord Howe's Island: lvs. light green and shining above, bluish green beneath; spines yellowish green.

BB. *Upper side of lvs. more or less keeled on each half.*

2. **furcàta,** Roxb. (*P. caricòsa*, Hort.). A fast grower; large specimens occasionally flower in German conservatories and then branch. Lvs. light green; spines lighter, marginal ones erect, those of the keel below recurved.

3. **Candelàbrum,** Beauv. In this and No. 2 the stems are thin and the aërial roots very thick. Lvs. blue-green;

1632. Young specimen of Pandanus utilis.
(Rather narrower-lvd. than the type).

spines light colored, tipped brown. The inference is that this species is distinguished from No. 2 by the spines of the lower keel not being recurved.

AA. *Young plants with scarcely any stem.*

4. **reflèxa,** de Vriese. Lvs. strongly reflexed; spines on margin and lower keel strong; no keels above. *P. ornàta*, Lam., lacks the spines on the lower keel, but is otherwise the same.

1633. Pandanus utilis.
An old Screw Pine in the tropics. (Adapted from The Garden.)

AAA. *Young plants freely branched from the ground.*

B. *Spines absent or only a few at the apex of lvs.*

5. **lævis,** Roxb. (*P. odoratissima*, Noronha). (Not adv. in America, but inserted because of its synonym and the interest attaching to a spineless Pandanus.)

BB. *Spines present and sharp.*

C. *Upper side of lvs. flat on each half.*

6. **pygmæa,** Thouars (*P. graminifòlia*, Hort.). Dwarf, and densely bushy, with many aërial roots: lvs. dark green; marginal spines whitish.

CC. *Upper side of lvs. more or less keeled on each half.*

7. **nitida,** Kurz. (*P. graminifòlia*, Hort.). Shrubby, attaining 8 ft. Lvs. remarkably shiny on both sides; the lower keel lacks spines.

8. **Javánica,** Hort. Bushy: lvs. dark green above, only slightly shining, beautifully striped with white, marginal spines straight; spines of the lower keel bent back. *P. Veitchii*, Lem. Lvs. shining on both sides, striped yellowish white, sometimes all yellowish white, spines not half as long as in *P. Javanica.* W. M.

PANICULÀRIA (Latin name referring to the panicled spikelets). *Glyceria* of the trade. *Gramineæ.* A large genus of swamp grasses inhabiting all parts of the temperate zone, and characterized by ample panicles, many-fld. spikelets with only the 2 lower glumes empty; the others firm in texture, obtuse, strongly 5–7-nerved, rounded on the back, and without cobwebby hairs; styles present. Only the following are in the American trade:

Americàna, MacM. (*Glycèria grándis*, Wats., also Hort. *Glycèria aquática*, Amer. authors). REED MEADOW-GRASS. Tall, erect and stout (3–5 ft. high), glabrous: lvs. large and broad (3–8 lines broad), spreading: panicle very large (8–15 in. long), mostly dark brown, its

branches long and spreading: spikelets 4–7-fld., 2–3 lines long: flowering glumes 1 line long. North America. —Good for planting in wet places for the margins of aquatic gardens, etc.

nervàta, Kuntze (*Glycèria nervàta,* Trin., also Hort.). NERVED MANNA-GRASS. Lower and more slender (1–3 ft. high), erect, glabrous: lvs. much smaller (2–3 lines wide): panicle 3–8 in. long, greenish, its branches long and spreading: spikelets 3–7-fld., 1–1½ lines long; flowering glumes three-fourths of a line long. North America.—A graceful native grass growing in damp ground or shady places. K. M. WIEGAND.

PÁNICUM (old Latin name of Italian millet, *Setaria Itálica*, said to be derived from *paniculum*, a panicle; alluding to the usual form of the inflorescence). *Graminèæ.* An immense genus of grasses scattered over the world, especially in the tropics. Several hundred species have been described, while conservative authorities place the number at about 300. Several of our bad weeds belong to this genus, such as crab grass (*P. sanguinale*), and barnyard grass (*P. Crus-gálli*), also several food plants, as Indian millet (*P. miliàceum*), Souwa millet (*P. frumentàceum*), and Shama millet (*P. colonum*). Their importance as forage grasses is very insignificant when the number of species is taken into consideration. This is largely from the fact that the species, as a rule, are not gregarious, and to the fact that they are not well represented in the meadows and prairies of temperate and northern regions. An important forage grass of the warmer regions is, however, guinea grass (*P. máximum*). Spikelets with one terminal perfect flower, and below this a second flower which may be staminate, neutral or reduced to a glume; therefore 4 glumes, the 2 lower and often the third being empty. The flowering glume is characterized by being of a much firmer texture.

virgàtum, Linn. An upright grass with stiff culms, 2–6 ft. high: spikelets in loose, compound panicles, usually more or less purplish, sharp-pointed; first glume half as long as spikelets, 5–7-nerved, second and third glumes of about equal length, 5–7-nerved. A hardy perennial used for ornamental purposes. Native of eastern U. S. R.H. 1890, p. 525; 1896, p. 572. M. 14, p. 215; 29, p. 235; 37, p. 245.

sulcàtum, Aubl. A tall perennial, 4–6 ft., native of tropical America: lvs. large, 1 in. or more broad, somewhat hairy, conspicuously plicate: panicle narrow, about 1 ft. long, with many ascending branches, bearing short-pedicelled spikelets throughout their length, and also scattered bristles: spikelets pointed: lower glume one-half, second glume two-thirds the length of third and fourth, all strongly nerved.

plicàtum, Lam. Called "palm grass" in the South, where it is cultivated for ornament. Native of East Indies. Resembles the preceding, but lvs. broader and nearly smooth, and panicle larger and more bristly: spikelets similar. R.H. 1862, p. 290; 1896, p. 572. Gn. 12, p. 517; 31, p. 487; 37, p. 245.—Woolson, of Passaic, N. J., says it grows 4–6 ft. high in the hardy border and makes a fine stately grass; useful for winter bouquets. A variegated form is figured in F.S. 17:1743 under the name *fólius níveo-vittátis.*

Crus-gálli, Linn. BARNYARD GRASS. The cultivated form is known as Japan Barnyard millet. The ordinary form is a weed in cultivated soil. The form in the trade is used for fodder. Another form or closely allied species (*P. frumentàceum*) is used in India for its grain. Panicle made up of numerous dense alternate spikes: spikelets crowded on two sides of a 3-sided axis; second and third glumes more or less awned. Annual.

capillàre, Linn. OLD WITCH GRASS. A common native annual grass and weed, recommended for cultivation on account of its ornamental purple panicle, which is ample and loose, the spikelets being borne on slender hair-like pedicels. R.H. 1890, p. 525; 1896, p. 572.

miliàceum, Linn. TRUE MILLET. BROOMCORN MILLET. Spikelets all pedicellate in an umbel-like, drooping panicle, each with 3 empty glumes and 1 flower.—A tall annual grass (3–4 ft.) with soft lvs., grown for fodder, but not in common use in this country. Cultivated from prehistoric times. Grown somewhat extensively in China and Japan, and southeast Russia. Native country unknown, but probably East Indies. More fully discussed in Farmer's Bulletin, No. 101 U. S. Dept. Agric. What is usually grown in the United States under the name of Millet is *Setaria Itálica* and its varieties.

P. variegàtum=Oplismenus Burmanni. For *P. Germánicum*, see Setaria. A. S. HITCHCOCK.

PANSY. The Pansy is everywhere a familiar flower. There is much character in it. The flower is often likened to a face. It appeals to personal feeling. In fact, the word Pansy is only a corruption of the French *pensée*, meaning thought. The old folk-name, heart's-ease, is also associated with the familiar place which the plant has occupied; it signifies remembrance. The Pansy is one of the oldest of garden flowers. Parkinson mentions it as a flower-garden subject in 1629. When critical study began to be given to the kinds of plants, the Pansy was so distinct from wild species that its specific identity could not be determined with precision, and, in fact, this is the case to the present day. It is generally considered, however, that it has descended from *Viola tricolor* (see *Viola*), a small perennial violet native to the cooler parts of Europe. In its nearly normal or unimproved forms, *Viola tricolor* is now grown in gardens. Fig. 1634. It is a most interesting plant, because handsome-flowered and variable. The flowers of this violet usually have three colors or shades, mostly blue, whitish and yellow, but in the different varieties one of the colors strongly predominates. A form with very small and inconspicuous flowers (var. *arvensis*) has run wild in many parts of the country.

1634. Viola tricolor.

Nearly or quite the original form of Pansy.

Pansies are perennial, but they are grown practically as winter or spring annuals. Commercial growers sow the seeds in fall, and sell great quantities of the seedling plants before winter sets in. These plants are bloomed in frames or cold greenhouses, or they are planted in the open for spring bloom. Plants are also started indoors in late winter for spring bloom. Pansies delight in cool, moist weather; hence the American summer is not to their liking, and they usually perish. A new stock of plants is started every year.

The modern improved Pansies run in strains or families rather than in definite varieties. These strains are maintained at a high grade by the best cultivation and the closest attention to selection. The seed of the best strains is necessarily expensive, for it represents much human care. The stock usually runs down quickly in other hands. It should be renewed from the seed-breeder each year if the best results are to be maintained. These fancy and high-bred strains require extra care in the growing. Most of the best strains are of European origin. They are usually known by the name of the breeder. The chief points of merit in the high-bred Pansy are size of flower, brilliancy of coloring, arrangement of colors. The flowers may be self-colored (of only one color) or parti-colored. The parti-colored flowers are of three general types: 2 banner petals and 3 central petals of different colors; petals all margined with lighter color; petals all striped. There are all grades of intermediate differences. The colors which are now found in Pansies are pure white, purple-black, pure yellow, different shades of blue, purple, violet, red-purple. Pansy flowers are now grown 3 in across. Fig. 1635.

With the above account may be compared Gerard's description of Pansies in 1587. He pictures the Hearts-ease or *Viola tricolor* with small violet-like flowers, the

petals standing apart from each other. The "Upright Heartsease," or *Viola assurgens tricolor*, is represented as a stouter and more erect plant, with rounder but scarcely larger flowers. These are described as follows: "The Hearts-ease or Pansie hath many round leaves at the first comming up; afterward they grow somewhat longer, sleightly cut about the edges, trailing or creeping upon the ground: the stalks are weake and tender, whereupon grow floures in form & figure like the Violet, and for the most part of the same bignesse, of three sundry colours, whereof it tooke the syrname *Tricolor*, that is to say, purple, yellow and white or blew; by reason of the beauty and braverie of which colours they are very pleasing to the eye, for smel they have little or none at all. The seed is contained in little knaps of the begnesse of a Tare, which come forth after the floures be fallen, and do open of themselves when the seed is ripe. The root is nothing else but as it were a bundle of threddy strings.

"The upright Pansie bringeth forth long leaves deeply cut in the edges, sharp-pointed, of a bleake or pale green colour, set upon slender, upright stalks, cornered, jointed, or kneed a foot high or higher; whereupon grow very faire floures of three colours, viz., of purple, blew and yellow in shape like the common Hearts-ease, but greater and fairer; which colours are so excellently and orderly placed, that they bring great delight to the beholders, though they have little or no smell at all: for oftentimes it hapneth that the uppermost floures are differing from those that grow upon the middle of the plant, and those vary from the lowermost, as Nature list to dally with things of such beanty. The seed is like that of the precedent."

L. H. B.

The Pansy is truly a "plant for the million." Its ease of cultivation, hardiness and cheapness have made it one of the most popular plants in this country. The under-

1635. Modern Pansies. Nearly ½ natural size.

signed is inclined to believe that as many plants of Pansies are sold as of all other plants.

Pansies were first improved from the original type in Great Britain, where the cool and moist climate is well adapted to their cultivation, and new varieties were gradually brought out with larger flowers of varied colors. For many years England and Scotland bore the reputation of growing the best Pansies. About twenty-five years ago, however, three French specialists, Bugnot, of St. Brieuc, and Cassier and Trimardeau, of Paris, made immense strides in developing the Pansy, and their productions were a revelation to the horticultural world. Such sizes and colors were previously thought impossible. Trimardeau created a new race with immense flowers and very hardy constitution. His strain crossed with those of Cassier and Bugnot has given a Pansy which is superseding the older English varieties. It must be admitted, however, that the best results can be obtained only at the expense of much care and cultivation and selection, and specialists only can be expected to reach the greatest degree of perfection. The strains degenerate very soon unless constant attention and care are bestowed on the plants. Contrast the flowers grown by Cassier and Bugnot themselves with the strains sold nowadays generally under their names! The choicest flowers are removed so far from the type that they produce but little seed and that of short vitality. The seed has to be gathered by hand, and it is necessary to go over the seed-beds every day. With the cheap and common strains less careful methods of seed-gathering are used. At the time of harvesting the plants are all pulled out and laid in the shade for the seed to slowly ripen, when the seeds are all cleaned at once.

In this country, with more extremes in temperature, more care must be exercised than in Europe in the selection of localities and exposure, and with the best of care Pansies will not last very long in bloom. A position sheltered from high winds and exposed to the morning sun will be found the most favorable, and soil of a chayish nature well enriched will grow the best Pansies. Frequent sprinklings also, to keep the ground and foliage moist, will be of great benefit. The general sowing for the production of early spring bloom is made out of doors in August, while seeds sown indoors from February to June will produce plants to flower intermittently during late summer and the fall months.

When sowing Pansy seed on a considerable scale in August, sow the seed broadcast in a seed-bed out of doors, cover very lightly with fine soil or well-rotted manure, and press the seed in with a small board; then mulch the seed-bed with long, strawy horse manure, from which the small particles have been shaken off, to the thickness of one inch, so as to have the soil well and evenly covered. At the end of two weeks the plants will be up. Then remove the straw gradually, a little at a time, selecting a dull day if possible. Keep the bed moist. This process for germinating Pansy seed is recommended by Cassier, and the undersigned from his own experience recommends it above all others. In England and Scotland the choicest varieties are perpetuated by means of cuttings, but it seems to be impossible to maintain the size for any length of time by this means in North America.

If Pansies are desired for winter bloom, plant them as soon as they are large enough on beds or benches near the glass in the greenhouse. The temperature for violets suits them very well. They are grown to a slight extent for cut-flowers.

If wanted for exhibition purposes, keep them in a lower temperature till January; some freezing, even, will benefit them. Start them slowly into growth at a temperature of between 30–40° at night, as a higher temperature will diminish the size of the flowers. A weak solution of guano or hen manure once every two weeks will help them wonderfully. Flowers 4 in. across can be grown for exhibition. During growth and bloom maintain a rather low, even temperature, without actual freezing, carefully avoiding extremes in temperature.

In favored localities Pansies designed for early spring bloom receive no glass protection during winter, the plants from the August sowing being transplanted in the fall from the seed-bed directly into their permanent quarters. Good Pansies can be grown out-of-doors without glass protection as far north as Nova Scotia. Generally, however, it is much better to winter Pansies in a coldframe, especially the finer strains. Pansies in bloom should be partially shaded from the hot midday sun, particularly the fancy-colored strains, the petals of which are more delicate in texture.

Denys Zirngiebel.

PAPAVER (old Latin name of dubious derivation). *Papaveraceæ*. Poppy. Poppies rank among the most popular annual flowers in cultivation. From their astonishing range of color, and from the formidable list of names given below, one might suppose their botany very complicated. It is, however, easy to understand. There are only 4 species commonly cultivated and these are all remarkably distinct. They are (1) the Opium Poppy, (2) the Corn Poppy, (3) the Iceland Poppy and (4) the Oriental Poppy.

1. The Opium Poppy, *P. somniferum*, one of the commonest and the most variable. It is an annual, of tall, stately habit, and recognized at once by the glaucous hue of its foliage. The flowers are the largest of any of the annual species, but unfortunately they are useless as cut-flowers because they drop their petals.

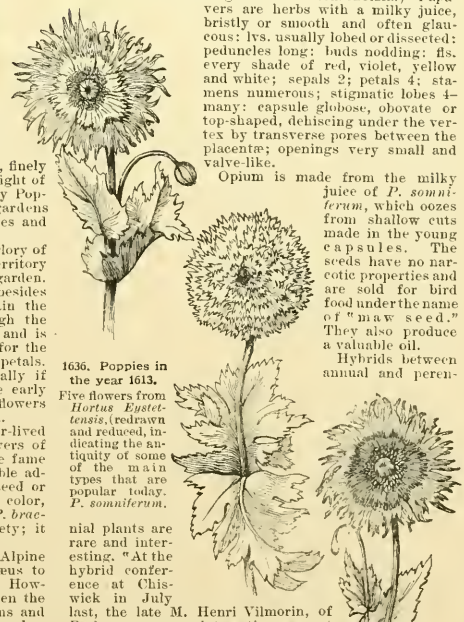
2. The Corn Poppy of Europe, *P. Rhœas*, is also an annual, but a dwarfer plant, with green, hairy, finely cut foliage and smaller flowers. This is the delight of every American that visits Europe. The Shirley Poppies are the best strain of this species; in our gardens the flowers last longer than the common Poppies and the plants are neater when out of bloom.

3. The Iceland Poppy, *P. nudicaule*, is the glory of the Arctic regions. It ranges over an immense territory and varies remarkably both in the wild and the garden. Orange, red and white are the chief colors, besides shades of yellow, but the flowers never attain the brilliant scarlet of the Corn Poppy. Although the Iceland Poppy is a perennial, it is short-lived and is commonly treated as an annual. It is known for the satiny texture and crimped character of its petals. The flowers are excellent for cutting, especially if the young flowers are selected and cut in the early morning, a principle which applies to many flowers often supposed to be useless for home decoration.

4. The Oriental Poppy, *P. orientale*, is a longer-lived perennial, and although it has the largest flowers of any species in the genus it has nothing like the fame of the Opium Poppy. However, it has the double advantage of being easily propagated by either seed or division, and it has a considerable range of color, which is said to be largely due to crosses with *P. bracteatum*. The latter may be only a botanical variety; it differs in having large bracts below the flower.

The other species are for the fancier. The Alpine Poppy, *P. alpinum*, was considered by Linnæus to be a distinct species from the Iceland Poppy. However, every gradation has been discovered between the typical form of *P. nudicaule* of the arctic regions and the common Poppy found in the Alps. The former has a yellow flower, while the common Alpine Poppy is white. Botanically, the Poppy of the Alps is generally regarded as an extreme form of *P. nudicaule*, characterized by a dwarfer habit and more finely divided foliage. For horticultural purposes *P. nudicaule* and *alpinum* should be considered to be distinct species. The Iceland Poppy can be easily grown in the border, while the Alpine Poppy demands rock-garden treatment. The former does best in a moderately rich and light loam, while the latter does better in a rather poor soil. Both need full exposure to the sun, and *P. alpinum* probably needs better drainage. The form of *P. alpinum* which has white petals with a green spot at the base may be considered the typical one. This is shown in color in Gn. 24:410, and also in Correvon's pocket guide to the wild flowers of the Alps, entitled *Flore Coloriée*, etc. Correvon states that the yellow-fld. form (var. *flaviflorum*) is found in the granitic Alps, the inference being that the white-fld. form is characteristic of the calcareous Alps. An orange-red Poppy is also found in the Alps and on the continent is often called *P. Pyrenaicum*. The tendency in England is to make it a variety of *P. nudicaule*. Whether all these plants are species or varieties and how they should be named are matters of opinion. The range of color has been indicated above. Aside from color, the important points on which these varieties are made and unmade are as follows: the degree of hairiness of stem and capsule; whether the hairs are appressed or spreading; the manner in which the foliage is cut, and the shape of the capsule, which varies from short, thick and snbglobose to long, narrow and club-shaped.

Papaver is a genus of about 50 species, mostly natives of the Mediterranean region. There is, however, one in South Africa and another in Australia. Also a true Papaver has been discovered in California, and has been named *P. Californicum*. (The "California Poppy" of gardens is Eschscholzia.) Papavers are herbs with a milky juice, bristly or smooth and often glaucous: lvs. usually lobed or dissected: peduncles long: buds nodding: fls. every shade of red, violet, yellow and white; sepals 2; petals 4; stamens numerous; stigmatic lobes 4–many: capsule globose, obovate or top-shaped, dehiscing under the vertex by transverse pores between the placentæ; openings very small and valve-like.



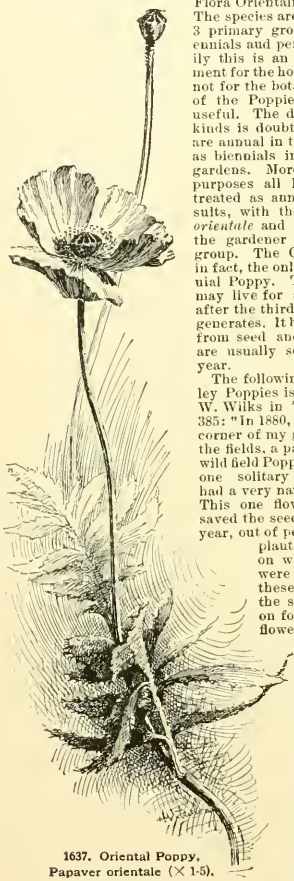
1636. Poppies in the year 1613. Five flowers from *Hortus Eystettensis*, redrawn and reduced, indicating the antiquity of some of the main types that are popular today. *P. somniferum*.

Opium is made from the milky juice of *P. somniferum*, which oozes from shallow cuts made in the young capsules. The seeds have no narcotic properties and are sold for bird food under the name of "maw seed." They also produce a valuable oil.

Hybrids between annual and perennial plants are rare and interesting. "At the hybrid conference at Chiswick in July last, the late M. Henri Vilmorin, of Paris, gave a very interesting account of a successful attempt at hybridizing the Opium Poppy (*P. somniferum*) with *P. orientale* or *P. bracteatum*, the

hybrids of which did not produce seed until they were again cross-fertilized with *P. orientale*, when a permanent race of showy plants that grow freely from seeds was obtained." *F. W. Burbidge*, in Gn. 56, p. 321 (1899).

There is no garden monograph of Poppies, but the student may find an account of 38 species in Boissier's Flora Orientalis 1:105–118 (1867). The species are there arranged in 3 primary groups,—annuals, biennials and perennials. Ordinarily this is an excellent arrangement for the horticulturist, though not for the botanist. In the case of the Poppies it is not very useful. The duration of several kinds is doubtful, species which are annual in the South behaving as biennials in northern botanic gardens. Moreover, for garden purposes all Poppies are to be treated as annuals for best results, with the exception of *P. orientale* and *bracteatum*, which the gardener thinks of as one group. The Oriental Poppy is, in fact, the only long-lived perennial Poppy. The Iceland Poppy may live for several years, but after the third year it usually degenerates. It blooms the first year from seed and the best results are usually secured the second year.



1637. Oriental Poppy, Papaver orientale (× 1-5).

The following account of Shirley Poppies is given by the Rev. W. Wilks in The Garden 57, p. 385: "In 1880, I noticed in a waste corner of my garden, abutting on the fields, a patch of the common wild field Poppy (*Papaver Rhœas*), one solitary flower of which had a very narrow edge of white. This one flower I marked and saved the seed of it alone. Next year, out of perhaps two hundred plants, I had four or five on which all the flowers were edged. The best of these were marked and the seed saved, and so on for several years, the flowers all the while getting a larger infusion of white to tone down the red until they arrived at quite pale pink and one plant absolutely pure white. I then set myself to change the black central portions of the flowers from black to yellow or white, and having at last fixed a strain with petals varying in color from the brightest scarlet to pure white, with all shades of pink between and all varieties of flakes and edged flowers also, but all having yellow or white stamens, anthers and pollen, and a white base." * * * Mr. Wilks then distributed it freely to all. "My ideal," he continues, "is to get a yellow *P. Rhœas*, and I have already obtained many distinct shades of salmon. The Shirley Poppies have thus been obtained simply by selection and elimination. * * *

Let it be noticed that true Shirley Poppies (1) are single, (2) always have a white base with (3) yellow or white stamens, anthers and pollen, (4) never have the smallest particle of black about them. Double Poppies and Poppies with black centers may be greatly admired by some, but they are not Shirley Poppies. It is rather interesting to reflect that the gardens of the whole world—rich man's and poor man's alike—are to-day furnished with Poppies which are the direct descendants of one single capsule of seed raised in the garden of the Shirley Vicarage so lately as August, 1880."

W. M.

There is no way in which the lover of color in flowers can gratify his taste so cheaply and so fully as by growing a good selection of Poppies. No other flower will make such a gorgeous show in the border during the months of July and the first half of August. To grow the finest Poppies, plant the seed as early in the spring as the ground can be worked. Cover very lightly, for if planted deep the seed does not germinate. The best way is to make the bed smooth and fine, scatter the seed thinly, then rake gently, and firm the soil well with a board or, better still, with the back of a hoe. When the plants are up 2 or 3 in., thin to 6 in. apart for the weaker growing varieties and 12 in. for the strong growing *P. somniferum*. Pick all the pods as soon as the petals drop, unless one desires to save seed. This treatment lengthens the blooming season and saves a lot of trouble the next year. The seed is quite hardy, and if left to ripen, the seedlings come up in countless numbers the following spring. An advantage of self-sown seed is that the plants bloom two weeks earlier than if planted in the spring. Poppies must always be planted where they are to bloom, as no annual Poppy will bear transplanting. Poppies are so susceptible to cross-fertilization that new strains are constantly arising. The ease with which they can be originated has led to much confusion in the seed catalogues.

P. somniferum, the Opium Poppy, is the commonest kind in cult. and is sufficiently described elsewhere.

P. Rhœas, the scarlet field Poppy of Great Britain, is the parent of many beautiful forms. Fig. 1638. Of these the best is the Shirley, the loveliest of all Poppies; the flowers are of the most delicate silky texture and in every imaginable shade and combination of white, pink, and red, with yellow anthers. Var. *umbrosum*, the Fire Dragon of some catalogues, is dark cardinal, with a black blotch at the base of each petal, and purplish black anthers. *P. lævigatum* resembles *P. umbrosum*, the fls. being the same color, but the black blotch is margined with white and the petals are more upright, not opening out so flat as in *P. Rhœas*. Sometimes *P. lævigatum* comes semi-double, but with this exception all the smaller double Poppies are forms of *P. Rhœas*. The ranunculus-fld. has all the gracefulness of the single form, with a wonderful diversity of color, white through pink to the deepest crimson, and in every degree of doubleness from 2 or 3 rows of petals to perfectly double. The varieties *umbrosum* and Shirley show a tendency to come double, though never so completely as the ranunculus-fld. The Rosebud and New Japanese Pompone are selections from the ranunculus-fld. type. "Golden Gate" is a mixture of *P. umbrosum*, *P. lævigatum* and *P. ranunculiflorum* in single and double.

The best of the perennial Poppies are *P. nudicaule* and *orientale*. *P. nudicaule*, the Iceland Poppy, is one of our most desirable perennials. Fig. 1639. If the flowers are cut regularly and no seed-pods allowed to form, it is in bloom from May to October. The fls. are on wiry stalks 12 in. or more long, and well adapted for cutting. The colors are white, yellow, and orange-red; they are easily grown from seed, and will bloom the first year if sown early. It is well to grow new plants every second year, as in the colder parts of the country it is subject to winter-killing when the plants get old.

Very different from the dainty Iceland is the gorgeous Oriental Poppy, one of our most striking and showy garden plants. Fig. 1637. The great fls., 6–8 in. across, deep scarlet with a bluish purple base and stamens, are held well above the foliage on stout leafy stalks. Unfortunately, the flowering season is short: 2 or 3 weeks in June and their glory is gone. They also are easily grown from seed and are very hardy. *P. bracteatum*, deeper in color and more robust, is, strictly speaking, a variety of *P. orientale*. Other varieties have orange, pink, and salmon-colored flowers, but none of them are so effective in the garden border as the type.

P. glaucum, the Tulip Poppy, is a weak, spindly

grower if planted thickly. The fls. are of an intense cardinal color, without black blotch; the outer petals much larger than the inner, overlapping at the edges, giving it the appearance of a tulip. *P. arenarium*, in the writer's experience, is scarcely worth growing.

R. B. WHYTE.

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1. **somniferum,** Linn. OPIUM POPPY. Fig. 1636. Robust, glaucous and glabrous plant, 3–4 ft. high, with fls. 4–5 in. across, much larger than those of any annual kind. Lvs. oblong, unequally toothed at the base; stem-lvs. cordate at the base: petals orbiculate, every shade from white through pink and red to purple, but not yellow or blue: capsule obovate, stalked, with a flat disk. Greece, Orient. Gn. 9, p. 197. Gt. 40, p. 609; 44, p. 593. R.H. 1893, p. 349. S.H. 2:272.

Among the double forms there are two main strains or types, the carnation-fld. and the pæony-fld. (the latter *P. pæoniæflorum*, Hort.). The former has fringed petals; the latter not. Both include a wide range of color, and even a yellow form is advertised, but this form is of doubtful authenticity. *P. Marsellii* is another strain of double fringed kinds, of which Mikado is a favorite. *P. fimbriatum* is another trade name for double fringed varieties. *P. cardinale* is not a botanical name. It is the French name of Cardinal, another strain of double fringed fls. Chinese Poppies are a double-fld. race introduced from Chinese gardens in the early nineties and comprising dwarfer than strains previously known. R.H. 1893, p. 349. An exceptionally interesting monstrosity has occurred in which there are no petals, and the stamens are supposed to be transformed into pistils which actually ripen seed. It was figured as long ago as 1851 in F.S. 6, p. 242 and again in R.H. 1893, p. 349. It seems to be no longer advertised, but it was considered constant.

Among the single varieties, Danebrog is one of the most striking and popular. The white spots at the base of the petals form a cross. This var. is also known as Danish Cross, Danish Flag and Victorian Cross. Of the pure white kinds, Flag of Truce and The Bride are favorites. Mephisto is scarlet, spotted black. About a dozen other varieties are advertised by name.

Var. **setigerum** (*P. setigerum*, DC.). *P. setigerum* is no longer advertised, but according to Nicholson numerous fine strains have originated from it. *P. setigerum* is now considered a hairy form of *P. somniferum*. It is a violet-fld. plant native to Corsica and Hyères. It differs in having oblong lvs. which are incised-toothed, the teeth being narrower and more pointed; also the capsule is not stalked, as it sometimes is in *P. somniferum*. S.B.F.G. 172.

2. **orientàle,** Linn. ORIENTAL POPPY. Fig. 1637–8. This and the next are the most robust and large-fld. Poppies; also the best, commonest and longest lived of the perennials. Plants grow 3–4 ft. high and bear fls. 6 in. or more across. Lvs. hispid, pinnately parted; lobes oblong-lanceolate, serrate: capsule obovate, with a flat disk: stigmatic rays 11–15. In *P. orientale* the petals are originally scarlet with a black spot. It was not until late in the eighties that this species made a decided break in color. A considerable class of hybrids with *P. bracteatum* has arisen which extends the color range through several shades of red to orange, salmon and pale pink. Some are unspotted, some are adapted to cutting, and doubling has made some progress. Among the Latin names of varieties belonging to this class are **grandiflòrum, hybridum, immaculàtum, nànum, splèndens, Párkmanni, plènum, semiplènum,** and **Sintenisii.** About a dozen have received common or personal names. Asia Minor. Persia. Gn. 24, p. 459; 42:890. V. 12:33.—T. D. Hatfield makes the following notes: "Oriental Poppies are better divided after blooming, in late July or August. They always grow in the autumn, and these divided plants would start away and make good growth. If divided in spring, they would not recover in time to bloom. Any extra good variety can be increased largely by cutting the roots into short pieces. This also is best done in the summer time."

3. **bracteàtum,** Lindl. (*P. orientàle*, var. *bracteàtum*). Differs from the preceding in having large, leafy bracts. According to Boissier the color of this species in the wild is blood-red and of *P. orientale* scarlet. Also the fls. of *P. bracteatum* are said to be earlier, the lvs. concave instead of flat and the stigmatic rays 16–18 instead of 11–15. Caucasus, Persia. B.R. 8:658. G.C. 1860:647. —A variety with petals more or less united into one was mentioned in 1862–5 in F.S. 15, p. 186, but it seems to be unknown now. Vars. **hybridum, Párkmanni, præcox** and **róseum** are advertised. See also species No. 2. *P. involucratum*, var. *maximum*, Haage & Schmidt, seems to be a new and undescribed kind. The name suggests that it may belong here.

4. **Rhœas,** Linn. CORN POPPY. This is typically a dwarf, green, bristly plant, with pinnately parted foliage and fls. about 2 in. across, two of the petals smaller than the others, all scarlet and spotted black. Height 2 ft. or less. In cultivation every shade known to the Opium Poppy has been reproduced in the Corn Poppy, but the fls. are always smaller. In the wild it varies greatly, the foliage once or twice pinnately

parted, the bristles many or few, appressed or spreading, the fls. spotted or not. Eu., Orient. Gn. 30, p. 297. —Up to 1886 the French Poppies were considered the best strain. Since then the lovely strain known as Shirley Poppies has surpassed all others. This strain was developed by the Rev. W. Wilks, secretary of the Royal Horticultural Society. It is one of the finest contributions to floriculture ever made by an amateur (see p. 1206). Var. **ranunculiflòrum**, Hort., is a strain with

1638. Oriental Poppy, Papaver orientale (× ⅛).

double fls. in various colors, self and variegated, with the petals entire, rounded and somewhat reflexed. Var. **Japònicum**, Hort., is a strain introduced about 1893 from Japanese gardens, and said to have smaller and fuller fls. than ordinary and of more varied shades. They are called Japanese or Japanese Pompons. Rhœas was the name used by the ancient Greeks and Romans for the Corn Poppy.

Var. **umbròsum**, Mottet(*P. umbròsum*, Hort.), is a plant with petals of a darker red than the typical *P. Rhœas* and blackish spots. It was introduced by Vilmorin about 1891, and was considered a marked gain in productiveness. The habit is dwarf, compact, much branched. Soon after a double form was distributed. Mottet considers it a form of *P. Rhœas*, but some botanists consider it a form of *P. commutatum*. Judging from a single trade specimen, the undersigned supposes it is a nearly glabrous form of *P. Rhœas*; the buds are bristly, but otherwise the plant has only a very few appressed hairs on the peduncles and on the lvs. along the midribs. *P. umbrosum* was found growing wild in Attica. *P. commutatum* is a species closely allied to *P. Rhœas*, and differs in having the petals obovate and not overlapping instead of orbicular and overlapping, while the anthers are ovate instead of oblong. R.H. 1891, p. 431; 1893:12; 1893, p. 350. G.C. II. 22:49. V. 9:187.

Var. **Hoòkeri** (*P. Hoòkeri*, Baker). A puzzling plant found in the gardens of India, and of unknown parentage. It is nearest to *P. Rhœas*, and "differs in its great size, for it forms a bushy herb 4 ft. high and upwards, and in the great number of the stigmatic rays, which are 12–20, i. e., nearly double those of *P. Rhœas*; the fls., capsule and seeds also are much larger and the stigma broader in proportion." The fls. attain 3½ in. in diam., and vary from pale rose to bright crimson, with a white or black spot at the base. B.M. 6729. Gn. 29, p. 139. G.C. II. 25:9. Procurable from England.—Said to revert occasionally to *P. Rhœas*.

5. **rupífragum**, var. **Atlánticum**, Ball (*P. Atlánticum*, Haage & Schmidt). Hoary and everywhere covered with copious spreading hairs except the glabrous capsule: height 1–2 ft.: lvs. oblanceolate; hairs spreading: fls. 2–3 in. across; petals orange-red or scarlet; stigmatic rays 6–8; capsule club-shaped. Morocco, 6,000–7,000 ft. B.M. 7107.

6. **Caucásicum**, Bieb. (*P. floribúndum*, Desf.). Biennial, more or less setose: lvs. bipinnately parted or dissected: buds ovate: calyx glabrous or sparsely setose: petals somewhat in pairs: stigmatic rays 3–6. Caucasus. B.M. 1675 (brick-red, not spotted). B.R. 2:134.

7. **arenárium**, Bieb. Annual, sparingly beset with bristles which are spreading on the stem and appressed on the foliage: lvs. twice pinnatisect into minute linear strips: fls. purple, with a dark spot at the base of each petal; filaments not dilated: capsule obovate or top-shaped, with a convex disk: stigmatic rays 7–9. Sandy places in Caucasus and Caspian region.—Procurable in England.

8. **lævigàtum**, Bieb. Glabrous or with a few small bristles: fls. purple, usually spotted; petals minute, obovate: capsule narrowly top-shaped or club-shaped: stigmatic rays 8–10. Greece, Orient.—It is doubtful whether the plant sold under this name is true, for in G.C. III. 5:31 it is shown with large, roundish, overlapping petals.

9. **Californìcum**, Gray. Annual, sparsely pilose-pubescent, 1–2½ ft. high: lvs. pinnately parted or divided into acutish toothed or 3-lobed or entire segments: fls. 2 in. across; petals brick-red, with a green spot at the base bordered with rose-red: capsule between club- and top-shaped, flat on top. Santa Inez Mountains and northward in California. Offered in 1891 by Peter Henderson, who described it as "pinkish orange with center of sulphur-yellow." Probably procurable from Calif.

10. **rupífragum**, Boiss. & Reut. Dull green, nearly glabrous. Spain. The typical form offered in England. See No. 5.

11. **glaùcum**, Boiss. & Hausskn. Tulip Poppy. Perennial, glaucous and glabrous except a few small, appressed bristles along the peduncles, branched at the base: stem-lvs. broadly cordate at the base, pinnately lobed or parted; the lobes triangular, dentate; the teeth obtuse, callous, muticous: petals large, scarlet, spotted at the base: capsule ovate, stalked: stigmatic rays about 12. Syria. Gt. 40, p. 608, repeated in G.C. III. 10:527. R.B. 20, p. 58. S.H. 2:467 and V. 15:37. R.H. 1892, p. 463; 1893, p. 350. Int. 1891 by Benary, of Erfurt.—The charming plant sold under this name reminds one immediately of a tulip because of the color and texture of the flower, but especially because of its cup-like shape. The two inner petals are smaller, erect, and make a loose cup. The plants grow about 12–14 in. high and produce 50–60 large fls.

12. **aculeàtum**, Thunb. (*P. Gariepìnum*, Burch. *P. hórridum*, DC.). Annual, 1–4 ft. high: stem branched, densely covered with spreading, rigid, unequal bristles: lvs. green, sinuately pinnatifid, the laciniations spine-tipped: fls. scarcely 2 in. across; petals scarlet-orange, unspotted: capsule glabrous, oblong-obovate. S. Africa, Australia. B.M. 3623.—The only Poppy known to inhabit the southern hemisphere. Procurable in England. Annual in S. Africa, but said to be biennial in northern botanic gardens.

13. **pilòsum**, Sibth. and Sm. Perennial. This flower is about 3 in. across, brick-red, the petals all of a size and with a pale spot at the base: stems tall and scabrous, freely branched: lvs. covered with velvety, appressed hairs; stem-lvs. clasping, broadly oblong, lobed and serrate: capsule glabrous, oblong-club-shaped: stigmatic rays 6–7. Rocky alpine heights of Mt. Olympus in Bithynia. B.M. 4749. Gn. 41, p. 277; 42, p. 585.

14. **nudicaùle**, Linn. Iceland Poppy. Fig. 1639. Typically a yellow-fld. arctic perennial, more robust than the next, with divisions of the lvs. entire or sparingly cleft, and capsule short, thick and roundish. In America this form is found as far south as southern Colo. on the peaks of the Rockies. Gn. 26:464; 24, p. 342; 28, p. 58; 42, p. 584. V. 13:297. B.M. 1633; 3035 and R.H. 1890:60 (*P. croceum*). F.S. 10:1017 (as var. *croceum*). The following varieties are advertised in the trade: **álbum, aurantiacum, coccineum, cróceum, striàtum** and **sulphùreum.** Double forms in the various colors are advertised. Older names which are likely to reappear are vars. **lùteum, puniceum,** and **rubro-aurantiacum,** B.M. 2344. *P. cróceum,* Ledeb., a native of the Altai Mts., is a form nearer to *P. nudicaule* than it is to *alpinum.* The name "nudicaule" refers to the lack of lvs. on the stem which distinguishes this and the Alpine Poppy from the common Corn Poppy of Europe. *P. Greenlandicum,* Hort., is possibly a catalogue name for *P. nudicaule.*

1639. Iceland Poppy, Papaver nudicaule (×⅓).

15. **alpinum,** Linn. Alpine Poppy. Typically a fragrant white-fld. perennial of the Europeau Alps, of dwarfer habit, with divisions of the lvs. cut into many fine and narrow secondary divisions, and a longer and narrower capsule approaching club shape. Gn. 24:410. L.B.C. 5:434. The following varieties are advertised: **albiflòrum, álbum, aurantiacum, flaviflòrum, flàvum, Pyrenàicum, roseum** and **rùbrum.** *P. lùteum,* Hort. Ellwanger and Barry, belongs here, but *P. lùteum* of the botanists is the Welsh Poppy, *Meconopsis Cambrica.*

16. **Pavoninum,** Fisch. & Meyer (*P. Pavònium,* Nicholson Dict. Gard.). Peacock Poppy. Annual, sparsely hispid-pilose: lvs. pinnately parted, the divisions oblong-linear and incised-toothed: petals scarlet, dark-spotted: capsule minute, ovate: stigmatic rays 4–5. Sandy places of Turkestan and Afghanistan. G.C. II. 26:329.—Botanically it is very distinct by reason of 2 short, horn-like appendages, one on each sepal near the tip on the back. Int. 1886 by W. Thompson, Ipswich, Eng., who added the following points: "dwarf, 1 ft. high, neater and less weedy than most annual Poppies: petals with a gray spot at the base and a horse-shoe-shaped hand of black. In the early part of the day the flower seems to have a white eye, surrounded by one complete ring of black." A good plant produced 100 flowers.

17. **Pérsicum,** Lindl. Biennial, setose-hispid: stem tall, branchiug, pyramidate: lvs. pinnately parted: buds oblong: calyx setose: petals overlapping at the margin: capsule large: stigmatic rays 5–6. Persia. B.R. 19:1570 (petals brick-red, with or without a white spot at the base). This has been, and may still be, confused in the trade with *P. Caucasicum.* Both are glaucous, and both advertised in England, but they are biennials.

P. álbum, Hort. Bridgeman, is presumably a double white-fld. variety of the Opium Poppy.—*P. coccíneum,* Hort. Bridgeman, is presumably a double scarlet-fld. variety of the common Poppy.—*P. maculàtum,* var. *superbum,* Haage & Schmidt, is presumably a form of one of the common species. W. M.

PAPAW is *Carica Papaya;* also *Asimina.*

PAPER MULBERRY. See *Broussonetia.*

PAPER PLANT. See *Cyperus Papyrus* and *Papyrus antiquorum.*

PAPHÍNIA (Paphos, city of Cyprus, sacred to Venus). *Orchidàceæ.* A rare and pretty genus of orchids, having the habit of small Lycastes. The curiously shaped fls. are borne on pendent scapes which are mostly 2-fld. Sepals and petals similar, spreading; mentum obsolete: labellum uppermost in the flower. They may be easily grown with Lycastes, and should be planted in fibrous peat and moss. During the growing period they require a liberal supply of water.

cristàta, Lindl. Pseudobulbs ovate, 1–3-lvd.: lvs. lanceolate, 4–6 in. long: scapes pendent, 1–2-fld.: sepals and petals lanceolate, acuminate, spreading, the latter a little smaller; all streaked above and transversely banded below with deep crimson or chocolate-brown markings on a whitish ground; labellum much smaller, chocolate-purple; the 2 lateral lobes oblong, pointed, half spreading, separated from the middle lobe by a deep constriction; middle lobe triangular-rhomboid, with an erect crest and clavate glands on the disk, and bordered in front by a fringe of clavate hairs. June–Aug. Trinidad. B.M. 4836. B.R. 21:1811 (as *Maxillaria cristata*).

rugòsa, Reichb. f. Pseudobulbs small, rounded: lvs. small, linear, acuminate: fls. waxy, creamy white, covered with red spots, which run together in blotches. Colombia.

grandiflòra, Rodrig. (*P. grándis,* Reichb. f.). Fls. chocolate-brown, striated on the lower half of the sepals and petals with greenish yellow and cream color, margins cream: labellum dark purple at the base, with an oblong, cream-colored middle lobe, and a pair of small lobes on each side. Brazil. G.C. III. 14:561.—A curious orchid.

P. Lawrenciana = Lycaste Lawrenciana?

Heinrich Hasselbring.

PAPHIOPÈDILUM (Paphinia (above) and word for *sandal*). *Orchidàceæ.* A section of Cypripedium separated by Pfitzer. It is distinguished by the 3-loculed ovary and by the conduplicate arrangement of the lvs. in the

bud. Pfitzer writes in Engler & Prantl's Pflanzenfamilien that the "ovary is completely 3-loculed, or 1-loculed below and only the tip divided into 3 locules." The species have not been revised and will be found under Cypripedium and Selenipedium.

P. barbàtum, Pfitz. (Cypripedium barbatum, Lindl.).—*P. Boxàlli*, Pfitz. (Cypripedium Boxalli, Reichb. f.).—*P. caudàtum*, Pfitz. (Selenipedium caudatum, Reichb. f.).

HEINRICH HASSELBRING.

PAPPOOSE ROOT or BLUE COHOSH is *Caulophyllum thalictroides*, a native plant that does not appear to be in the general trade.

PAPŸRUS antiquòrum (Fig. 1640), the Egyptian Paper-plant, is *Cyperus Papyrus*, which see for technical description. It is a tall-growing, graceful aquatic, bearing an umbel of long and slender branchlets. It does not endure frost. It is much used for bedding out about ponds in the summer. The plants for bedding are

1640. Papyrus antiquorum.

propagated in January and February, by division of the roots that were brought in from the open in autumn. The plants are kept quiet until the roots are divided. The roots are divided into small pieces, and the divisions are started in a warm sand propagating bed. As the plants grow, they are potted. By late spring the plants should be ready for use in shallow pools in the open.

L. H. B.

PARACHUTE FLOWER, adv. by Blanc, 1900, is *Ceropègia Sándersoni*, Decaisne, from So. Africa. *Asclepiadàceæ*. It is a tall-twining plant with fls. of most unusual shape and structure. It is figured in B.M. 5792, from which the following extracts are taken: "Stems stout, succulent, as thick as a goose-quill. . . . Lvs. small and distant for the size of the plant, shortly stoutly petioled, 1½–2½ in. long, ovate-cordate, obtuse, thick and succulent, nerveless, deep green like the stems. . . . Corolla 2½ in. long, curved at the base, tube 2 in. broad across the top; tube slightly inflated and green at the base, expanding into a funnel-shaped, 5-angled transparent limb with opaque green reticulated veins; this presents 5 short distant lobes on its margin, which bears the 5 curious horizontal appendages that together form the umbraculiform cap to the flower: this cap is a bright verdigris-green, pitted on the surface and formed of 5 confluent convex lobes with a conical central papilla; each lobe is 2-lobed at its outer margin, and the margins are turned up and bear a series of transparent, flat, erect hairs within the border."

Ceropegia contains about 80 species, mostly African. Several species are known in European collections, but when the first volume of this Cyclopedia was written none had been offered in the American trade. Some of them are bulbous-rooted. They demand a warm or intermediate house, and are propagated by cuttings of the stems. All the species are odd.

L. H. B.

PARADÍSEA (said to be from Paradise, of which this plant is supposed to be a fit inhabitant). Often written *Paradisia*. ST. BRUNO'S LILY. *Liliàceæ*. St. Bruno's Lily and St. Bernard's Lily are advertised in nearly every good-sized catalogue of hardy herbaceous plants, as *Anthéricum Liliastrum* and *Anthéricum Liliago*, but the former should be called *Paradisea Liliastrum*. Both these plants have white, lily-like fls., borne in early summer on scapes a foot or more high. The fls. of both are tipped green outside. The lvs. are linear, all radical, and a foot or so long. Both plants are natives of middle Europe, and by their popular names recall the life-saving monks of the Alps. It is no wonder, then, that they are often confused. The Paradisea has larger fls., which are funnel-shaped rather than rotate, but the fundamental differences upon which Paradisea is made a separate genus lie in the stamens. In Paradisea (according to Bentham & Hooker), the anthers are attached at the middle of the back and are versatile; in Anthericum the anthers are attached at their base and are erect. Moreover, the stamens of Paradisea are hypogynous; of Anthericum, perigynous. Following are some of the other differences as given by Baker in Journ. Linn. Soc. 15:286, 287, 301 (1877):

Paradisea Liliástrum, Bertol., has 6–8 lvs.: scape 12–24 in. high: raceme 2–10-fld.: bracts lanceolate: perianth 18–21 lines long: style 15–18 lines long; ovary and capsule oblong.

Anthericum Liliàgo, Linn., has 12–20 lvs.: scape 6–15 in. high: raceme (sometimes paniculed) 10–20-fld.: bracts linear: perianth 6–9 lines long: style 5–6 lines long: ovary and capsule globose. Some of the above characters will not hold for cultivated plants.

P. Liliastrum, var. *major*, Hort., is said to be a much larger and better form than the type, growing 2–3 ft. high and bearing more and larger fls. Gn. 9:1 (as *Anthericum Liliastrum* var.) has fls. 2 in. long and 2½ in. across.

W. M.

PARADISE FLOWER. *Strelitzia regina*.

PARAGUAY TEA. *Ilex Paraguariensis*, not in the Amer. trade.

PARA NUT. *Bertholletia*.

PARASITE. A parasitic plant is one which fastens itself upon another plant (or other organism), and, stimulated by the latter, either grows into its interior, or sends certain sucking organs into its tissues by means of which a part or all the nourishment necessary for the Parasite is obtained. A plant which lives upon dead organic substance is termed a saprophyte (which see). The most common Parasites are to be found among the fungi, which are the abundant causes of plant diseases,—such as rusts, smuts, and mildews. These fungous Parasites secure all of their nourishment from the host, or plant attacked, and most commonly grow within the tissues until ready to form their reproductive bodies, or spores. There are also Parasites among flowering plants. Of these there are two principal classes: (1) those green in color, or chlorophyll-containing, such as the mistletoe and the bastard toad-flax; and (2) those practically devoid of chlorophyll, such as the dodder

Plate XXV. Example of the large rural Park.—View in Prospect Park, Brooklyn

and the broom-rape. Members of the first class are active photosynthetically, and may manufacture their own carbonaceous material from CO_2 and water, while members of the second class must receive all or nearly all similar foods from the host. There are all gradations between Parasites and saprophytes; there are plants parasitic at one stage and saprophytic at another, and there are those which are at once parasitic and saprophytic. B. M. Duggar.

PARASOL, CHINESE. *Sterculia platanifolia.*

PARASOL FIR or TREE. *Sciadopitys verticillata.*

PARASOL PINE. *Pinus Pinea.*

PARDÁNTHUS. See *Belemcanda.*

PÁRIS (name discussed below). Herb Paris. Love Apple. *Liliàceæ.* Everyone who knows and loves a Trillium will be interested in the Herb Paris, which differs from a Trillium in having its floral parts in 4's instead of 3's. There are about 8 species altogether, and in some of them the floral parts are in higher numbers than four. They resemble Trilliums in being small, hardy, rhizomatous plants, found in mountainous countries of the north temperate zone, and even in the arctic regions. Also they have a single whorl of lvs. at the top of the scape and a single flower, but in Paris the outer perianth segments are more herbaceous and calyx-like, while the inner ones are much narrower and less showy, being mere strips of petal or even entirely absent.

The name Paris is an interesting one. The berry of the plant is compared to the apple of discord, while the four leaves surrounding it are likened to Paris and the three envious goddesses, Juno, Minerva and Venus. Others think the name is derived from *par*, equal, referring to the agreement in number between leaves and floral parts.

quadrifòlia, Linn. Herb Paris. True Love. Height 9–12 in.: lvs. netted-veined (very exceptional among monocotyledons): peduncle rising 1–2 in. above lvs.: perianth segments yellowish green, the 4 inner ones rather more yellow: berry bluish black. Rarely the lvs. and floral parts are in 5's. The dominant European type, scattered all over Eu. and Siberia from the Arctic circle to the Mediterranean, in woods and shady places, but usually very local. Fls. in spring or early summer. Gn. 31, p. 165.—Not advertised in America at present. W. M.

PARIS DAISY. *Chrysanthemum frutescens.*

PARÍTIUM tiliàceum is referred to Hibiscus in this work. It is a handsome shrub or small tree, of 10 to 30 feet, bearing considerable general resemblance to the cotton plant, for which travelers have sometimes mistaken it. In Porto Rico it is often planted for hedges along roadsides, and is very abundant in waste places near the sea. It was already widely distributed in America in prehistoric times, and has now been introduced throughout the tropics.

It is valued for its very strong bast fiber, which has much similarity to jute, but differs in the peculiar property of maintaining or even increasing its strength after long maceration in water. The extraction of the fiber for the manufacture of cordage and other purposes offers no special difficulties. It has also been recommended for paper-making. At present it is utilized in Porto Rico for domestic purposes only, all the home-made ropes being twisted from it. The conditions are, however, very favorable for the cultivation of *emajagua* on a large scale, should more extensive industrial uses be found for it. O. F. Cook.

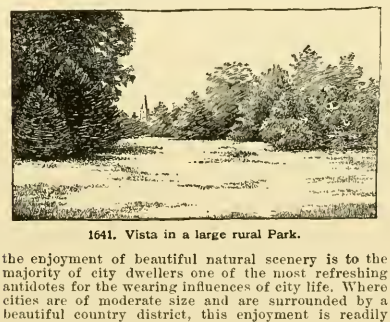
PARK. Plate XXV. A tract of considerable size set apart primarily for enjoyment. Meaning originally, in England, a place for the preservation of deer for the chase, the word is often used now to denote the landscape character commonly associated with such deer parks. In the United States, when the original signification is meant, the word is modified, as deer park, game park, etc. As a type of landscape the park is characterized by comparatively broad stretches of pasture lying between irregularly and rather widely spaced masses of tree foliage. It is extremely simple and quiet in character, and while it often contains many other elements, such as ponds or running water, thickets of bushes under the trees or occasionally outstanding, houses, bridges or other artificial structures, these features are all subordinate as well as harmonious if the scene can be called typically park-like.

Private Parks attached to country houses, in America, are usually so called because they have, or are intended to have, something of this park-like type of scenery. A place departing very widely from this type is called, according to its character, a wood or grove, a garden, a farm, or more vaguely by the general term country-place.

Public Parks are so called, not because their scenery is necessarily of the type properly associated with the word "park," but because converted Royal Parks were the most notable public pleasure grounds of English cities at the time when they began to feel the need of making municipal provision for the outdoor recreation of their growing populations. The earliest important pleasure grounds of municipal construction were based upon these and upon private parks as models, and the name "park" came to be so attached to municipal undertakings in the way of outdoor recreation, that it is now almost indiscriminately applied to any tract of land set apart for public enjoyment, regardless of the kind of enjoyment or the character of its scenery; but the best usage appears to confine the meaning of public park to a tract of considerable size, leaving the lesser spaces to be called squares, gardens, playgrounds, places, etc. Another special use of the word in America is its application to tracts of land in the West, many square miles in extent, either set apart by government, as Yellowstone Park, or naturally distinguished by the presence of comparatively gentle grazing land in the midst of rougher country. "Park" is also used in a more general way to indicate the general purpose of any open land devoted to public recreation, or of the organization controlling it, etc., as "park system," "park department," etc.

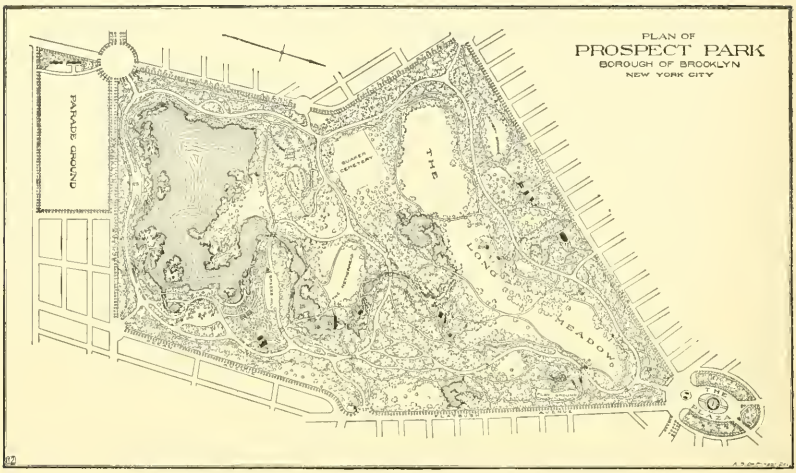
A large city park system usually contains parks of varying size and character and many smaller pleasure grounds. No rigid classification can be made, but the following may be regarded as reasonably distinct types, each having its own field of usefulness, its own merits and its own limitations. In practice the lines between these types cannot be distinctly drawn, but poor results are often due to losing sight of the distinct and often conflicting motives which have given rise to these types.

1. *The large rural Park* (Plate XXV. Figs. 1641–3), generally from 200 to 1,000 acres, is in most cases the chief feature of a city park system. It is seldom undertaken except by large cities or cities so rapidly growing that the need of such provision can be clearly foreseen. Its main object is to provide conveniently in some degree for the inhabitants of large cities that sort of recreation which is to be obtained by strolling or driving in a pleasant country district. There is no doubt that



1641. Vista in a large rural Park.

the enjoyment of beautiful natural scenery is to the majority of city dwellers one of the most refreshing antidotes for the wearing influences of city life. Where cities are of moderate size and are surrounded by a beautiful country district, this enjoyment is readily accessible to the mass of the population, and it has for-



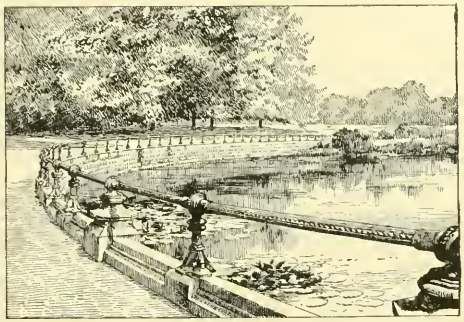
1642. Plan of Prospect Park, Brooklyn, to illustrate the large rural park.

tunately become more so in proportion to the size of the cities within the last fifteen years through the development of trolley car lines and the use of the bicycle; but this increased accessibility of the country has been in part offset by the growth of the cities during the same period, and by the serious impairment of the rural quiet of the suburban regions through the same cause—improved cheap transportation. It is therefore necessary, if the people of large cities are to have easy access to refreshing rural scenery, that the municipality should withdraw from its taxable area a tract sufficiently large to provide such scenery within its own limits. The cost, both directly in money and indirectly through interference with the street system and with the normal commercial development of the land, is necessarily very great, and only the purpose of providing beautiful scenery, thoroughly contrasting with the city life and measurably sequestered from all its sights and sounds, can justify this cost, because almost all the other purposes served in public recreation grounds can be met more economically and far more conveniently in smaller areas distributed throughout the city. The essential characteristics of a well-designed and well-managed park of this class are, therefore, that all of the numerous other objects which it may serve are subordinated to the provision of beautiful scenery and to rendering this scenery accessible and enjoyable by large numbers of people, and that the subordinate objects are met only in such ways and to such a degree as will not interfere with the simplicity and the rural and natural quality of the scenery.

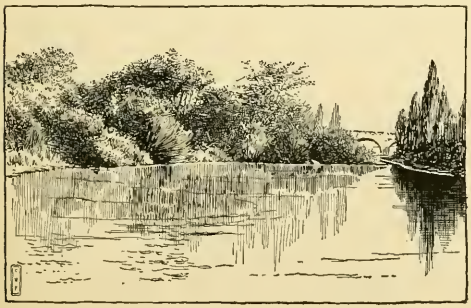
Although Central Park, in New York, is the most noted park of this class in America, it can hardly be taken as the most typical example on account of its rocky, complicated topography, its unfortunately narrow shape, owing to which the surrounding high buildings to a great extent dominate its scenery, and to the interruption offered by the great reservoirs which cut it into two independent parts. Prospect Park, in Brooklyn, begun in 1866, is here described in some detail for the purpose of affording a concrete example of the principles that the writer wishes to illustrate respecting rural parks. Fig. 1642 and Plate XXV.

Prospect Park has an area of 526¼ acres. Its main entrance is about 3½ miles from New York City Hall, or 1¾ miles from Brooklyn City Hall. It is approached from the city by four lines of trolley cars, but is at the city end of the Parkway System, so that it must be reached through ordinary streets. The chief features of its design are: 1st, the open, park-like landscape of the Long Meadow; 2d, the woodland section, hilly and rising to an elevated outlook; 3d, the lake and its surroundings; 4th, a series of minor passages of scenery and elements of interest fitted in at points not appropriated for the main effects. The most characteristic and most valuable part of the park is the Long Meadow with its surrounding masses of wood, from the shade of which the outlook ranges over one of the most beautiful and simple park landscapes in the country. But one is not brought directly to the Meadow from the outside streets. One goes at first through a formal plaza, then through a retired, shady ante-chamber, just long enough to give a sense of retirement from the city, then, if on foot, through an archway under the drive, that does away with the nervousness of crossing a throng of carriages, and then one comes out suddenly upon the joyous, sunny greensward. Its extent—over 50 acres—is enough to secure an effect of breadth and enlarged freedom without bringing its whole expanse into a single view. One can see that it reaches beyond the projecting groves and scattered trees that form the background of the main composition, and he is tempted to stroll on and open up the prospects thus suggested. The surrounding groves are freely used for picnic parties, and although much of the ground is tramped bare beneath the trees, but little serious harm is done. A carrousel or merry-go-round with its loud, mechanical organ, the only discordant feature of the place, was removed to this point a few years ago. This piece of apparatus was originally designed to be in a retired section devoted to children's games, where all sorts of amusing apparatus might be placed without intruding on the park at large. The children's playground, not being shady or attractive for its purpose, has now been transformed into a rose garden. On the lower edge of the Long Meadow are the pools which are at the source of the park ornamental water system. They illustrate both the value of water in a park landscape and the practical difficulty of securing and maintaining agreeable natural shores within the confines of a large city. Where the banks are clothed with shrubs the effect is admirable, but wherever the grass-land comes to the water's edge and in many places where shrubs once grew, the ground has become foot-worn to utter hareness. Little iron

railings in parks are in themselves no protection in great public resorts, and even wire fences may entirely fail to prevent people from trampling some of the shady banks and rockeries into barrenness. Adequate policing and prompt repair of points that cannot withstand too free use is the only remedy, and these should never be lacking in all city parks. Leaving the Meadow, the water flows down through a ravine in the woodland portion of the park, wholly overshadowed by trees with a varied undergrowth. Through this woodland section the paths and drives are comparatively narrow, numerous and intricate, as befits the intricacy and detail of sylvan scenery, and points of special interest are marked by simple rustic seats, shelters, outlooks, and the like. In the southern part of the park is a lake 62 acres in extent, of artificial formation, but of natural appearance. It is large enough to afford good boating in summer and skating in winter for large numbers, as well as providing innumerable broad and beautiful water views. Electric launches carry passengers around a 2¼-mile circuit for ten cents. The shores of the lake are for the most part wooded with tree plantations, now well grown, and are very attractive except where indiscriminate use has worn them bare or where the originally intended wild undergrowth is lacking. Parts of the shore have for contrast the open meadow character, a character which will be emphasized when some of the planted trees are cut, as necessary. Several important points were chosen in the design of the park as places for the gathering of large and dense crowds, and were planned with that end in view. The first of these was the concert grove near the east end of the lake. The great breadth of bare ground or pavement wherever large crowds gather frequently, makes absurd any attempt to simulate natnral scenery in snch a place, and in the design of the concert place a grove of formally planted trees with architectural accessories was made upon gently rising grounnd, arranged radially at one side of a little bay in the lake, upon an island in which the band-stand was to be placed. Upon another side of the bay a large concourse for carriages was also provided, and in connection with the formal treatment of the concert grove was built a shelter, a restaurant and a terrace overlooking the main drive. While the grove was still so yonng as to be unattractive a band-stand was erected in a natural grove near the Nethermead, a place in which the intricate woodland scenery with its brook and pools and shrubbery, and the correspondingly intricate arrangements of narrow paths and bridges, bridle path and drive, were unfitted for accommodating a large crowd. Here the people are now drawn in thousands, wheelmen, carriages, horses and people on foot, all trampling abont together among the trees and where the grass and bushes once grew, and blocking the narrow bridges. The unused concert place now has a display of bedding plants. The second gathering place was at the top of Lookout Hill, which rises 100 feet above the snrrounding country and commands a noble view extending out to sea. Here is a large carriage concourse, although a shelter and other provisions designed for those on foot are not provided. The plantations upon the flanks of the hill have now become so high and so continuous that the views are nearly closed. A third point, the Breeze Hill Concourse, which originally enjoyed a good view of the lake as well as a good breeze, has now grown up so that it is no longer attractive as a view-point and has been converted into a plantation for perennials, as a Colonial Garden. Of the other subordinated features of interest may be mentioned the Deer Paddock, the Wild Fowl Pond, the Vale of Cashmere, the Archery Gronnds and the Greenhouses. The space set apart on the plan for a Deer Paddock is a detached open area of suitable park-like kind; this land is now used as a nursery ground, and the deer have been introdnced on steep and broken ground in the midst of the woodland section. The Wild Fowl Pond is in snch a situation that there is little temptation to go down and injure its steep banks by walking along them, and the effects of the views from path, road and shelter across its snrface to the picturesque foliage of its opposite margin are admirable, especially when it is enlivened by moving birds. The Vale of Cashmere is a narrow valley containing a little winding pool and filled with a rich and varied massing of rhododendrons and other flowering shrubs and evergreens, growing in an irregular and pictnresque manner. However a visitor may be impressed by any of these special features with their strong, individnal characters, he need see none of them that he does not particularly care for, as they are all self-contained and do not obtrude themselves upon the dominant park landscape, for the sole object of securing which the limits of the park were extended to their present size. The above remarks illustrate the type of changes that are likely to occur in all public parks, and for this reason they may be suggestive to the reader.



1644. Edge of the concert grove in Prospect Park.



1643. Water scene in a large rural Park.

2. *The small city park* (Fig. 1644-5), from ten to two hundred acres or thereabouts, is usually an effort in the same general direction as the large rural park, with a limitation fixed by the difficulty of setting apart a large body of land in one piece at a point of access to a large population. It is almost impossible to attain within so small a space the degree of seclusion from the city and the sense of breadth, simplicity and freedom that are the essential featnres of the

landscape of a rural park; yet small passages of interesting and agreeable scenery are often attainable, and the obviously artificial objects which may intrude upon them can often be so treated as to harmonize with the effect. The scenery can seldom be quite natural in appearance, but it can often be very beautiful, a certain elaboration, elegance and even magnificence taking the place of the more quiet and restful simplicity of the large park, in a way that appeals very obviously to many people, and there is therefore more or less tendency to develop large parks in the same direction. It is unfortunate that it should be so, for as these ends can be attained almost as well upon small parks as upon large, it is clearly a mistake to treat one large park in this style instead of several of smaller size so distributed as to serve conveniently a larger population. It is because more cities have small parks of this elaborate and what might almost be called gardenesque treatment than have large and simple rural parks, that so many people have a perverted conception of what constitutes a park.

Morningside Park, New York (Fig. 1645), is an example of a small city park upon an extremely rugged and picturesque site, planned, in order to enhance this quality, with an avoidance of decorative elaboration. It occupies a craggy hillside strip from 200 to 500 feet wide and $\frac{2}{3}$ of a mile long, with a difference of elevation of from 50 to 100 feet between one side and the other, rendering the land unfit for streets or buildings. From its situation as well as its narrow shape it is essentially unsecluded; indeed one of its most notable features is the impressive and utterly unrural view which it offers over the busy streets and houses of Harlem, that stretch away from its base. This view and the boldness of the crags is emphasized by a stone terrace along the upper edge, supporting a promenade and a tree-lined boundary street. Convenience of passage is met by numerous broad paths, with masonry steps fitted to the irregularities of the ledges. The planting among the ledges was designed to be of the tangled sort such as often clothes broken ledges naturally, while the more level land at the base of the crags is treated by contrast as a smooth lawn, with scattered trees. The natural boldness of the crags is partly lost by an effort to extend turf over every possible area, and the shrub planting is possibly rather too garden-like in style to be in entire accord with the situation, but in general the park is treated in a manner approaching that of the large parks, although without any attempt at complete rural seclusion. It contains a little over thirty acres, exclusive of the various boundary streets and promenades.

More commonly small parks are used for the display of interesting and showy flowering shrubs and trees, and make a feature of fountains, statues and other sculpture more or less good. In moderation and skilfully used such objects, together with terraces and other architectural work, are entirely appropriate and desirable in parks of this class, and add much to the effect of elegance and richness. The predominant purpose is to please the eye, as in the large parks, but in a way that has often a little of the element of spectacular effect and certainly more of interest in the individual objects than in the case of the quiet rural park. The enjoyment is more closely related to that offered by architecture and decorative design and other pleasures forming a part of the daily city life.

3. *Neighborhood pleasure grounds* are spaces of varying size coming within the scope of the park system, and including numerous aims other than the enjoyment of scenery. Sometimes the leading feature is a playground for athletic sports, sometimes a sort of outdoor kindergarten for little children, sometimes a concert grove and promenade, sometimes a menagerie, sometimes a public bathing place or boating place. The area is usually restricted, and, as the name indicates, the object is to offer the maximum of outdoor recreation for the people of a single neighborhood, when they have not the time to go far afield. As children out of school hours are most in need of such provision, playgrounds form an important feature in many grounds of this class; but in all the best examples the means of meeting the various practical requirements, whether athletics, band concerts or what not, are so arranged as to produce a pleasing effect on the eye as well. This is the more difficult from the fact that these grounds get very hard usage: and it is practically impossible to maintain a respectable turf on the area devoted to a playground. This is sometimes left in loam worn bare in streaks and patches by the playing, but it is better surfaced with well-compacted gravel. So far as any single example can represent this class, which must vary in every element with local conditions, Charlesbank, in Boston, may be taken as an illustration. This playground occupies a tract of about ten acres upon the borders of the Charles river at a point near a district of considerable congestion, and occupied by a population of a poor class. A promenade was established on the edge of the sea wall about two thousand feet in length, and between it and the undisturbed streets a playground was laid out, having an average width of about two hundred and fifty feet. Within this long, narrow belt of public ground were established two outdoor gymnasia, each with a running track and a building for dressing and bathing. One of these outdoor gymnasia was designed for women and children and the other for men and boys, and they are at the opposite extremities of the playground. The tract between them was laid out with walks, trees, shrubs and turf, and was intended primarily to appeal to the æsthetic senses. The Charlesbank has well proved the practicability of maintaining, within the very heart of the city, a tract of ground occupied by greensward and trees despite the fact that it is frequented by thousands of men, women and children. The city of Boston provides free instruction in gymnastics upon the playground, and yearly over 70,000 women and girls, and 200,000 men and boys have made use of the facilities offered. The total cost of this playground for land and improvements to date is $382,000, and the yearly cost of maintenance is $10,000.

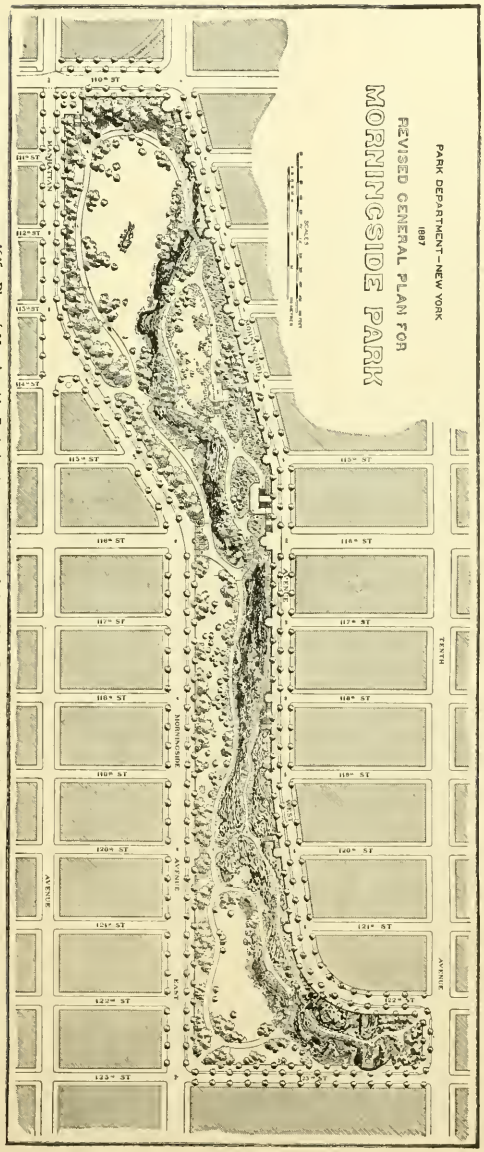
4. *Squares, places, gardens,* and the like, usually of small area, are scattered about a city at street intersections and the like. Their principal functions are to furnish agreeable sights for those passing by them or through them in the course of their daily business, and to provide a pleasant resting place or promenade for the much smaller number who take the time to use them so. On account of the almost constant passing through such squares the best arrangements all provide for reasonably direct and convenient paths along the lines most used. Where this is not done many of those who use the square are likely to be so irritated by the indirectness as to miss much of the pleasure they might otherwise receive. A formal plan of walks, either on straight lines or curved, is generally adopted for such squares, and is well suited to the conditions and to the decorative treatment of the area, providing much more effectively than an irregular plan for the numerous statues, fountains and gay flower beds which have their most appropriate location in such a place. Shade trees, either as a complete grove, or in rows along the paths, or grouped in some more complex plan, are almost essential features of such squares, but where displays of flowers are to be made open spaces must be left for sunlight. A modification of this type of square is sometimes met with where the space, instead of being used as a short cut and for enjoyment from within, is designed primarily to present an agreeable picture to those passing it upon the adjacent streets. When the area is very small and the passing is almost wholly along one side, and in other special cases, this treatment is most effective, because, where the only aim is a beautiful pictorial effect from a limited point of view, better results can be obtained than when appearances must be reconciled with other uses of the land. Nevertheless there are few cases in which a small square will not have a greater recreative value to the public if its pictorial aspect is somewhat sacrificed to such uses as resting and promenading.

5. *Parkways and boulevards* as parts of a park system serve usually as pleasant means of access to parks from other parts of the city, or from one park to another, and also as agreeable promenades in themselves. Commercial traffic is usually excluded from them. Boulevards are arranged formally, usually upon straight lines, with rows of shade trees and parallel

ways for those on foot and on wheels. The simplest type has a broad drive in the center with a walk on either side separated from the drive by a belt of turf and it is always shaded by trees. Frequently, two driveways are provided with a broad space between containing trees and turf, and sometimes foot paths, bicycle paths, bridle paths or other conveniences, and often shrubs, flowers, statues and other decorations. A further development is arranged like the first form, with the addition of narrow streets for house frontage on each side and with an enlargement and elaboration of the planting spaces between the middle and side drives. Of recent years some boulevards have been made to provide for electric car tracks upon a special turfed reservation with rows of trees, where the cars can attain high speed with little danger of collision with other vehicles. Such reservations are generally between two roadways, but in some suburban districts, notably in the city of Rochester, a single-track reservation is placed on either side of a single roadway between the curb and the sidewalk. A parkway, so far as it can be discriminated from a boulevard, includes more breadth of turf or planted ground and includes, usually, narrow passages of natural scenery of varying width, giving it a somewhat park-like character and inducing a less formal treatment of the roads, paths and accessory features. Parkways are frequently laid out along streams so as to include the natural beauties of brook or river scenery and to preserve the main surface-water channels in public control, thus providing for the adequate, economical and agreeable regulation of storm drainage and floods.

6. *Outlying reservations* of almost undeveloped country scenery, usually from 500 to 5,000 acres in extent, are wisely included in the park systems of some of the larger cities on account of the increasing difficulty of reaching the unspoiled scenery of the open country, and because, otherwise, the increasing numbers of people seeking such scenery upon the outskirts of the suburbs secure their pleasure at a constantly increasing discomfort to themselves and to the private landowners upon whose property they are forced to trespass. The most notable of such reservations in America are those of the Boston Metropolitan District, comprising four forest reservations with a total area of a little over 10,000 acres, with 17 miles of connecting parkways. The most notable of such reservations in Europe are those of London, especially Epping Forest (5,346 acres) and Richmond Park (2,358 acres); and those of Paris, amounting to about 20,000 acres, chiefly maintained, not by the city, but by the national government.

Management.—The most generally adopted and most successful method of managing city parks in the United States is by an unpaid commission of three to five members appointed for terms of three or five years and retiring successively, so as to maintain continuity of policy and comparative independence of local political changes. The commission appoints as executive officers a secretary and a superintendent, the latter having some technical skill, and each devoting his whole time to the work and receiving a salary. Under the orders of the superintendent, who receives his instructions



1645. Plan of Morningside Park, in the upper part of New York City, to illustrate the small City Park.

direct from the board, are employed an engineer, local superintendents, gardeners, foremen, etc. The engineer is generally an assistant of the city engineer, assigned temporarily to park work. When new parks are to be acquired or plans are to be made for their development, a professional landscape architect is employed to advise

1646. A park-like effect in a private garden.

the board and to make plans, and is usually retained at least in a consulting capacity during the period of construction. Some large cities retain a consulting landscape architect permanently to advise them with regard to questions of improvement and maintenance affecting the design of the parks.

Statistics.—Reliable statistics of parks are almost unattainable. The accompanying incomplete compilation (see foot of page) was made in 1897 by the secretary of the Louisville Park Commission. Some items are corrected to 1900.

Bibliography.—"Park" in American Cyclopedia, Encyclopedia Americana, Johnson's Cyclopedia; Park Reports of the various cities, especially New York, 1857–1868, special report accompanying plan of Central Park, 1858; Brooklyn, 1867–1873, special report accompanying plan of Prospect Park, 1866; Boston, 1879, 1880, 1885, city document 125 of 1880; Boston, Metropolitan District, 1893; Buffalo, 1871, 1886, 1888; Chicago, report on plan of South Park, 1871; Montreal, report on Mount Royal, with plan, 1881. See Proceedings American Social Science Association, 1870, 1880; "Mass. Park Law," state printers, 1894; Proc. Amer. Park and Outdoor Arts Assoc.

F. L. Olmsted, Jr.

PARKINSÒNIA (John Parkinson, 1567–1629, London apothecary, author of the delightful Paradisus Terrestris and Theatrum Botanicum). *Leguminòsæ.* Seven or 8 species of tropical trees or shrubs, often armed with short spines: lvs. bipinnate, with 1 or 2 pairs of pinnæ; the common petiole short, often obsolete or spinescent; stipules minute or none: fls. yellow or whitish, on slender pedicels in short, loose axillary or terminal racemes; calyx 5-parted, produced at base and jointed upon the pedicel; petals 5, clawed, the upper one within and broader than the rest, somewhat cordate, the claw pubescent and nectariferous on the inner side; stamens 10, free, the upper one gibbous outside: ovary several-ovuled, shortly stipitate: pod compressed, 2-valved, linear to linear-oblong, more or less twisted: seeds compressed, albuminous. Bot. Calif. 1:161.

The dominant type, both in the wild and in cult., is *P. aculeata*, the Jerusalem Thorn, which is probably a native of America, but is naturalized or cult. in all tropical countries. Another species is S. African, 3 are S. American, and the rest belong to the region between Texas and S. Calif. *P. aculeata* is a thorny evergreen tree with feathery drooping branches and handsome yellow fls.; it is admirable for hedges, thrives in the driest places and can endure some cold. It has been cult. in European conservatories, being usually raised from imported seeds, but it is of difficult culture. *P. Torreyana*, though generally destitute of lvs., is known in northern

Name of City.	*No. large parks.*	*Acreage.*	*Other spaces.*	*Acreage.*	*Total Acreage.*	*Total appropriation and cost.*	*Population.*	*Cost per capita.*	*No. inhabitants per acre.*
Albany, N. Y.	3	280	8	15	295	$2,135,700	100,000	$21 35	339
Baltimore, Md.	9	1,100	20	37	1,137	10,000,000	600,000	16 66	527
‡Boston, Mass., proper	9	1,894	28	465.57	2,359.57	16,627,033	530,000	31 37	224
‡Boston Metropolitan—Reservations,	13	9,279 46				9,545,528†			
Parkways	7	17.1M							
‡Buffalo	6	955	20	70.5	1,025.5	4,971,769	350,000	11 43	369
Cambridge, Mass.	1	137	2	21	158	1,021,500	81,650	12 51	516
Chicago, Ill.	9	2,097	23	497	2,594	29,561,660	1,800,000	16 42	694
Cincinnati, Ohio	6	400			400	2,000,000	300,000	6 66	750
Cleveland, Ohio	8	1,178	8	36	1,214	2,000,000	350,000	5 71	288
Des Moines, Iowa	4	400	3	5	405	116,000	75,000	1 55	185
Denver, Colo.	9	520	2	20	5 0	387,608	150,000	2 58	278
Duluth, Minn.	4	400	10	25	425	550,000	67,000	8 20	158
‡Essex County, N. J.	3	969.7	3	83.43	1,053.13	1,500,000			
Hartford, Conn.	6	1,060	9	7	1,067		70,000		65
Indianapolis, Ind.	1	89	2	27	116	290,000*	183,000	1 58	1,578
Kansas City, Mo.	3	1,338			1,338	100,000**	160,000	0 63	119
Louisville, Ky.	3	1,055	4	10	1,113	1,003,520	215,500	4 66	194
Parkway			1	48					
Milwaukee, Wis.	7	400	9	61	461	1,140,000	300,000	3 80	651
Minneapolis, Minn.	11	1,500	25	40	1,540	2,750,000	200,000	13 75	130
Boulevards	9								
New York City Park System					5,190	50,000,000	2,000,000	25 00	385
Borough of Brooklyn	2	1,052	29	523	1,575	30,000,000	1,300,000	23 07	825
Omaha, Neb.	6	550	3	2	552	750,000	140,000	5 35	254
Peoria, Ill.	4	322	3	12	334	350,000	60,000	5 83	180
Pittsburgh, Pa.	1	767			767	3,000,000	290,000	10 35	378
Philadelphia, Pa.	1	3,300	22	318	3,618	6,250,000	1,250,000	5 00	345
Richmond, Va.	4	354	9	31	385	132,000	100,000		267
St. Louis, Mo.	10	2,134	10	43	2,177	5,100,000	638,000		
St. Paul, Minn.	2	802	44	87	889	296,415***	133,200		174
San Francisco, Cal.	3	1,090	14	224	1,314	3,744,605	360,000	10 40	274
Springfield, Mass.	1	1,463	24	20	483	169,000	50,000	3 38	104
Toledo, Ohio	8	695	17	5		625,000	125,000	5 00	
Washington, D. C.	18	328	283	76	404	4,495,237	277,000	16 22	685
Wilmington, Del.	3	239.49	10	29.69	269.18	422,351.46	70,000	6 03	260

‡ Figures corrected to 1900.
† Includes maintenance 7 years.
* Condemnation on hand for more land.
** Condemnation.
*** Maintenance.

Mexico as *palo verde*, from the bright green color of the branches. It stands drought even better than *P. aculeata*. These plants belong to the same tribe with such fine northern trees as Gleditschia and Gymnocladus and such southern kinds as Cæsalpinia, Poinciana and Colvillea.

A. *Lfts. numerous: rachis flat, long.*

aculeàta, Linn. JERUSALEM THORN. Small, glabrous tree, the slender branches often pendulous: spiny petioles ½–1 in. long: lfts. very small, oblong; rachis ½–1½ ft. long: racemes axillary, 3–6 in. long: fls. fragrant, pendulous. S.S. 3:131.

AA. *Lfts. few: rachis terete.*

Torreyàna, Wats. Small tree: lfts. 2 or 3 pairs: racemes terminating the branches: pedicels jointed near the middle, the joint not evident until in fr. Valley of the Colo. and eastward. F. FRANCESCHI and W. M.

PARNÁSSIA (after Mt. Parnassus). *Saxifragàceæ*. GRASS OF PARNASSUS. About a dozen species of low-growing, moisture-loving, hardy perennial herbs, of tufted habit, each scape bearing a solitary, 5-petaled, white or yellowish flower ½–1½ in. across. They are suitable for shady positions along the water's edge, and are prop. by seeds or division. They generally grow about 6 in. high, but attain 2 ft. They bloom from June to September; the petals are conspicuously veined with 9 or more green lines. The plant which Dioscorides called "Grass of Parnassus" is *P. palustris*, the only species that is common in Europe. This is perhaps the best one for cult., but they are all much alike. Parnassias are suitable plants for moist, sunuy or partially shaded positions. They prefer a peaty soil, but such is not necessary. The species are generally tenacious of life and are good perennials. The North Carolinian species are hardy North.

Parnassias are natives of the north temperate and arctic zones. Calyx 5-parted: petals withering, but persistent: fertile stamens 5, alternating with the petals: ovary 1-celled: style very short or none: stigmas usually 4: ovules many: capsule 1-celled, with 4 placentæ projecting within, 4-valved.

A. *Petals not clawed.*

B. *Rudimentary stamens 9–20 at the base of each petal.*

C. *Scape-leaf clasping.*

palùstris, Linn. GRASS OF PARNASSUS. Lvs. ovate, usually cordate at the base: fls. ½–1 in. across: rudimentary stamens 9–15 at the base of each petal. Eu., Asia., N. Amer. Gn. 41, p. 500. A.G. 13:696.—In Eu. considered the commonest and best species, but in this country it seems to be advertised only by dealers in Japanese plants.

CC. *Scape-leaf not clasping.*

Califórnica, Greene. Height 1–2 ft.: lvs. ovate or ovate-oblong, 1–2 in. long; scape-leaf very small, and borne much above the middle: fls. 1½ in. across; rudimentary stamens about 20 at the base of each petal. Calif. Int. 1900, by Horsford.

BB. *Rudimentary stamens 3–5 at the base of each petal.*

Caroliniàna, Michx. Height 8–16 in.: lvs. ovate, broadly oval or orbicular, more or less cordate at the base; scape-leaf borne below the middle: fls. ¾–1½ in. across; rudimentary stamens usually 3 in each set. Swamps and low meadows, New Brunswick to Manitoba, south Va. to Ia. B.B. 2:182. B.M. 1459.—Commonest in cult.

AA. *Petals clawed.*

B. *Rudimentary stamens 3 at the base of each petal.*

asarifòlia, Vent. Height 10–16 in.: lvs. orbicular, kidney-shaped at the base, often 2–3 in. wide; scape-leaf clasping, borne at about the middle: petals not fringed. Wet places in high mts. of Va. and N. C. B.B. 2:184.

BB. *Rudimentary stamens 5–9 at the base of each petal.*

fimbriàta, Banks. Lvs. kidney-shaped to cordate-ovate: petals fringed below the middle. Colo. to Calif. and Brit. N. Amer. Int. by Gillett in 1881, and still cult.

P. rubicola, Wall. The largest and coarsest of all the species, and lacks the delicate beauty and white petals of P. palustris. Lvs. elliptic-ovate; scape-leaf borne below the middle: petals shorter than in the other kinds as compared with calyx lobes: rudimentary filaments 3, not topped by anthers. Himalayas. B.M. 6609. F. W. BARCLAY and W. M.

PARNASSUS, GRASS OF. See *Parnassia*.

PAROCHÈTUS (Greek, *near a lake*). *Leguminòsæ*. This plant was offered recently by A. Blanc, of Philadelphia, under the name of Shamrock Pea or Blue Oxalis. It is a half-hardy perennial trailer, with foliage like the shamrock, but with each of the 3 lfts. marked at the base with a handsome brown crescent; the pea-shaped fls., have a cobalt blue standard and pink wings. It is desirable for hanging baskets, pots and rockeries. Blanc says it blooms the year round. It is a native of tropical Asia and eastern Africa, ascending the Himalayas from 4,000 to 13,000 feet. If seeds could be secured from the greatest altitude the plants might be hardy in the North.

Parochetus is a genus of one species. It is allied to the clovers, sweet clover, medick and rest-harrow, and differs from them in having a more acute keel, a 2-valved pod, and the lfts. not stalked.

communis, Hamilt. SHAMROCK PEA. BLUE OXALIS. Height 2–3 in.: rhizome thread-like, wide-creeping: petiole 2 in. long: lfts. obovate, emarginate, glabrous or slightly pubescent: peduncles 1–2-fld.: fls. ½–¾ in. across, axillary. F S. 15:1575.

PARONÝCHIA (old Greek name used by Dioscorides, meaning whitlow-wort, or a cure for a disease of the fingers or toes). WHITLOW-WORT. *Illecebràceæ*; by Britton and Brown referred to *Caryophyllàceæ*. About 40 species of annual or perennial herbs, natives of the Mediterranean region, erect or diffuse, often dichotomously branching: lvs. opposite, broad or narrow, entire, the margins flat or very rarely recurved; stipules prominent, scarious, shining: fls. minute, without petals, axillary or rarely in terminal cymes, usually densely clustered and hidden among the stipules. A few are cult. in the hardy border, and 2 are said to be much used in bedding. The two European species here given do not appear in the leading catalogues, domestic or foreign, but *P. serpyllifolia* is said to be much used for carpet bedding abroad. Allied to Herniaria, which see for generic differences. The species described below are perennials. *P. argentea* furnishes the Algerian tea of medicine.

A. *Lvs. rather broad, obovate or nearly so.*

B. *Foliage nearly glabrous.*

argéntea, Lam. Prostrate, diffuse: lvs. obovate to oblong or lanceolate: fls. lateral and terminal, dense, intermixed with lvs.: bracts ovate, acute, much longer than the fl.; calyx-lobes semi-scarious, hooded, mucronate on the back near the apex. Common in dry places, Mediterranean region.

BB. *Foliage ciliate at the margin.*

serpyllifòlia, DC. Prostrate, creeping: lvs. obovate, flat, rather fleshy: fls. terminal; calyx-lobes blunt. Arid parts of southern and eastern Eu.

AA. *Lvs. narrow, linear or awl-shaped.*

B. *Awns of the calyx-segments erect.*

argyròcoma, Nutt. Erect or ascending, 3–8 in. high, clothed with silvery, appressed, scale-like hairs: lvs. linear; stipules silvery white, scarious, entire, usually shorter than the lvs.: fls. in forking cymes: bracts large, silvery, membranous. Rocky places. Me. and N. H. to Ga. and Tenn. Also called Silver Chickweed, Silverhead, and Silver Whitlow-wort. B.B. 2:38.

BB. *Awns of the calyx-segments divergent.*

dichótoma, Nutt. Woody at the base, glabrous or puberulent, 4–14 in. tall; stipules entire, often 5–6 lines long, tapering into a slender awn: fls. in forking cymes. Dry soil, Md. and N. C. to Ark. and Tex. B.B. 2: 39. Adv. 1883, by Woolson, Passaic, N. J. W. M.

Paronychia argyrocoma is an interesting little plant which shows remarkable geographical distribution; it occurs rather abundantly on the high rocky summits of the Carolina and Tennessee mountains, but does not appear northward in the Appalachian system till the peak of Mt. Washington is reached, where it grows sparingly; stations are also reported on several lower mountain tops in Maine. It is not difficult of cultivation and is prized for rockeries, its silvery tufted appearance lending a distinct charm to the collection for this purpose. Propagated by seeds and division.

HARLAN P. KELSEY.

PARRÒTIA (after F. W. Parrot, a German natnralist and traveler, afterwards professor of medicine at Dorpat; 1792–1841.). *Hamamelidàceæ.* Ornamental deciduous shrubs or small trees, with alternate, short-petioled, orbicular to oblong lvs., small fls. in dense heads appearing before the lvs., and with fr. similar to those of the Witch Hazel. The Persian species is hardy as far north as Mass. Its chief beauty consists in the brilliant autumnal tints of the foliage, which changes to golden yellow, orange and scarlet and remains a long time on the branches. The early appearing fls., with the purple pendulous stamens, are also attractive. The Himalayan species is much more tender and its foliage turns only to pale yellow, but the fls. are somewhat more showy from their rather large white bracts. The Parrotias grow in any well-drained soil and like a sheltered position. Prop. by seeds and layers and also by greenwood cuttings under glass. Two species in N. Persia and the Himalayas. The short petioles have large deciduous stipules: fls. small, in dense heads, surrounded by an involucre of several bracts; petals wanting; calyx 5–7-lobed, embracing the pubescent ovary about one-half; stamens 5–15; styles 2: capsule 2-celled, with 2 beaks, dehiscent between the beaks, with one oblong shining seed in each cell. The wood is very close-grained, hard and strong, and *P. Persica* bears therefore the name Ironwood. The tough pliable branches of the Himalayan species are extensively used for basket-work and are also twisted into thick ropes used for the construction of twig-bridges over the great rivers of its native country.

Persica, C. A. Mey. Shrub or small tree, to 15 ft., with spreading branches: lvs. oval to obovate-oblong, obtuse, coarsely and crenately dentate above the middle, dark green above, pubescent beneath when young, 3–4 in. long: bracts of flower-heads covered with dark brown tomentum: stamens 5–7, pendulons, with linear-oblong, purple anthers: fr. with recurved beaks. N. Persia. B.M. 5744.

Jacquemontiàna, Decaisne (*Fothergilla involucràta,* Falc.). Spreading shrub or small tree, to 20 ft.: lvs. orbicular, crenately toothed, stellate-pubescent on both sides, 2–4 in. long: heads many-fld., with spreading white bracts sprinkled with a purplish scurf on the back: stamens about 15, erect, with yellow, oval-oblong anthers. Himalayas. B.M. 7501. ALFRED REHDER.

PARROT'S BILL. See *Clianthus.*

PÁRRYA (Capt. W. E. Parry, Arctic explorer). *Cruciferæ.* Four or five North American and a few Asiatic low perennial scape-bearing herbs, with thick roots or caudices, narrow leaves and mostly racemose, white or purplish showy flowers: pod broad and flat, mostly elliptic, with orbicular seeds. The Parryas are alpine or boreal, often arctic plants, and some of them will no doubt prove useful for the alpine garden. So far they are practically unknown in American gardens. In 1881, Gillett introduced **P. Menziesii,** Greene (as *Cheiranthus Menziesii,* Benth. & Hook.). It has a leafy scape 3–8 in. high, with a raceme of many flowers, the petals nearly ½ in. long and bright purple. N. Calif., north to the Lower Columbia river. L. H. B.

PARSLEY. Fig. 1647. While indispensable in the market garden, Parsley is but rarely found in our home gardens. The addition of a bit of Parsley foliage, finely chopped, heightens the flavor of soups, fish, etc. The principal use of this vegetable, however, is

1647. Curl-leaved Parsley.

for garnishing meats and fish, and for this purpose it seems to be the vegetable par excellence, equally desirable in the home as on the hotel table. A very few plants will suffice for the home garden, and any spot of good soil will do for starting them from seed. Sow as early in spring as practicable, either in an early hotbed or coldframe, or in open ground. Parsley seed germinates somewhat slowly, and the plants are feeble at first. In open ground, early sowing aids the plants to get ahead of the weeds. In larger patches the rows should be a foot apart, and seed sown rather thinly in shallow drills. Thin the plants to stand a few inches apart, and cultivate same as carrots. Gather the leaf-stalks as needed. For use during winter and early spring, start plants in open ground in early fall, and on the approach of cold weather set them in a corner of the greenhouse bench, or in a box or keg filled with rich loam placed in a light kitchen or cellar window.

When the plant is a year old (sooner or later), it throws up seed-stalks, and produces seed in abundance, even under glass protection. By keeping the seed-stalks closely cut out, the season of leaf-yield may be prolonged for a time. Seed is easily gathered and cleaned.

The varietal differences appear chiefly in the foliage, which in some sorts is rather coarse, as in the Plain or Common, or more finely divided, as in the Curled, Double Curled, Moss Curled and Fern-Leaved.

For the botany of Parsley, see *Carum Petroselinum.*

T. GREINER.

PARSNIP (*Pastinaca sativa*). Fig. 1648. The average home gardener thinks much of quick results. The drawback to Parsnip growing, in his estimation, is the length of time which the crop requires for its development. When seed is sown, in early spring, the harvest seems a long way off. To offset this disadvantage, however, Parsnips become available as green material when other things fresh from the garden are very scarce or entirely absent, namely, during open spells in winter, and in the very early spring months. A crop of good, straight roots may not be quite as easily produced as a crop of smooth carrots, but when once grown, it does not burden one with much responsibility in regard to storage or keeping, which is an important point in its favor. The roots may be left in the ground where they grew or stored in moss or sand in the cellar. This feature makes them valuable also as food for cattle, sheep, hogs and poultry in the early spring in case the table or market should not call for them at that time.

1648. Parsnip.

The best soil for Parsnips is a clean, rich loam, which offers no obstruction to the uniform expansion of the roots. Prepare it the same as for beets or carrots, or

for any other garden crop. The seed should be strictly fresh, as it soon loses its vitality. Sow it in early spring, preferably with a garden seed-drill, ½–1 in. deep, in rows 15–20 in. apart in the garden, and somewhat farther in field culture. Be prompt in thinning the young seedlings to 3–4 in. apart in the row; at the same time pull up or cut out all weeds. The free use of the hand wheel-hoe will keep the patch clean until the entire surface of the ground is covered with foliage, thus preventing further growth of weeds. Cultivation may then cease.

The varieties are few in number. For shallow, stony or otherwise unfavorable soils we have the Round or Early Short Round; for better soils the Half-Long, Student, or Hollow Crown; and for deep, clean soils the Long Smooth.

Seed is easily grown. Plant the roots in spring in any good soil, and gather the seed heads when most of the seeds in them are mature. Dry them on sheets, and then thrash or strip.

For botanical account of Parsnip, see *Pastinaca*.

T. Greiner.

PARTHÈNIUM integrifòlium, the American Feverfew or Prairie Dock, has been offered by one dealer in hardy herbaceous perennials, but the plant is desirable only for foliage effects; and the fls. are not showy. It is pictured in B.B. 3:111 and described in American manuals. The genus has little horticultural value.

PARTRIDGE-BERRY. *Mitchella repens*. Sometimes applied to *Gaultheria procumbens*.

PASCÀLIA glaùca is a composite from Chile which is probably not in cult. The plant cult. under this name in England, and once offered by John Saul, is probably the plant shown in P.M. 8:125, which is believed to be a Helianthus. It is not hardy and there seems to be little reason for cultivating it here, because we have so many hardy sunflowers.

PASQUE FLOWER. *Anemone Pulsatilla*.

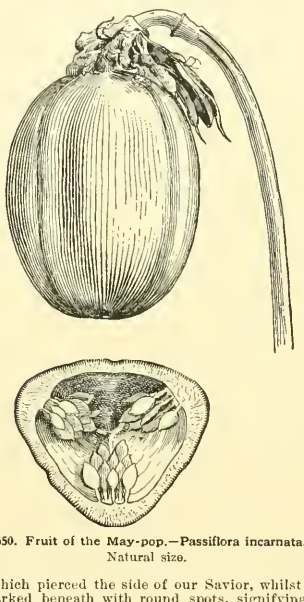
PASSIFLÒRA (i. e., *Passion flower*). *Passiflorâceæ*. Passion-flower. A large tropical genus of highly interesting herbs, shrubs, or trees, but most of them climbing by means of tendrils. The peculiar charm of these plants lies in the odd flowers, the parts of which were fancied by the early Spanish and Italian travelers to represent the implements of the crucifixion (whence both the technical and popular names). The flower is usually subtended by 2 or 3 calyx-like bracts. The calyx has 5 petal-like lobes. The corolla is of 5 petals. The ten colored parts of the floral envelope were thought to represent the 10 apostles present at the crucifixion, Peter and Judas being absent. Inside the corolla is a showy crown or corona of colored filaments or fringes, taken to represent the crown of thorns, or by some thought to be emblematic of the halo. The stamens are 5, to some suggestive of the five wounds, by others thought to be emblematic of the hammers which were used to drive the three nails, the latter being represented by the 3 styles with capitate stigmas. The long axillary coiling tendrils represented the cords or the scourges. The digitate leaves suggested the hands of the persecutors. Fig. 1649 is an old representation of the Passion-flower. Consult *Tacsonia*.

The following sketch of the Passion-flower legend is from Folkard's "Plant Lore, Legends and Lyrics," and the illustration (Fig. 1649) is also reproduced from that book: "The Passion-flower (*Passiflora cærulea*) is a wild flower of the South American forests, and it is said that the Spaniards, when they first saw the lovely bloom of this plant, as it hung in rich festoons from the branches of the forest trees, regarded the magnificent blossom as a token that the Indians should be converted to Christianity, as they saw in its several parts the emblems of the passion of our Lord. In the year 1610, Jacomo Bosio, the author of an exhaustive treatise on the cross of Calvary, was busily engaged on this work when there arrived in Rome an Augustinian friar, named Emmanuel de Villegas, a Mexican by birth. He brought with him, and showed to Bosio, the drawing of a flower so 'stupendously marvelous, that he hesitated making any mention of it in his book. However, some other drawings and descriptions were sent to him by inhabitants of New Spain, and certain Mexican Jesuits, sojourning at Rome, confirmed all the astonishing reports of this floral marvel; moreover, some Dominicans at Bologna engraved and published a drawing of it, accompanied by poems and descriptive essays. Bosio, therefore, conceived it to be his duty to present the *Flos Passionis* to the world as the most wondrous example of the *Croce trionfante* discovered in forest or field. The flower represents, he tells us, not so directly the cross of our Lord, as the past mysteries of the passion. It is a native of the Indies, of Peru, and of New Spain, where the Spaniards call it 'the Flower of the Five Wounds,' and it had clearly been designed by the great Creator that it might, in due time, assist in the conversion of the heathen among whom it grows. Alluding to the bell-like shape assumed by the flower during the greater part of its existence (i. e., whilst it is expanding and fading), Bosio remarks: 'And it may well be that, in his infinite wisdom, it pleased him to create it thus shut up and protected, as though to indicate that the wonderful mysteries of the cross and of his passion were to remain hidden from the heathen people of those countries until the time preordained by His Highest Majesty.' The figure given to the Passion-

1649. Old conception of the Passion-flower.
From Folkard's "Plant Lore," and there taken from Zahn.

flower in Bosio's work shows the crown of thorns twisted and plaited, the three nails, and the column of the flagellation just as they appear on ecclesiastical banners, etc. 'The upper petals,' writes Bosio in his description, 'are tawny in Peru, but in New Spain they are white, tinged with rose. The filaments above resemble a blood-coloured fringe, as though suggesting the scourge with which our blessed Lord was tormented. The column rises in the middle. The nails are above it; the crown of thorns encircles the column; and close in the center of the flower from which the column rises is a portion of a yellow colour, about the size of a reale, in which are five spots or stains of the hue of blood, evi-

dently setting forth the five wounds received by our Lord on the cross. The colour of the column, the crown, and the nails is a clear green. The crown itself is surrounded by a kind of veil or very fine hair, of a violet colour, the filaments of which number seventy-two, answering to the number of thorns with which, according to tradition, our Lord's crown was set; and the leaves of the plant, abundant and beautiful, are shaped like the head of a lance or pike, referring, no doubt, to



1650. Fruit of the May-pop.—Passiflora incarnata.
Natural size.

that which pierced the side of our Savior, whilst they are marked beneath with round spots, signifying the thirty pieces of silver."

With the exception of a few Malayan and Chinese species, the true Passifloras are natives of tropical America. Many of them are cultivated as curiosities, and some of them for the beauty of their flowers and for their festooning foliage. The leaves are either digitately lobed or angled or perfectly entire. The large, showy flowers are solitary in the axils or on axillary racemes. The fruit is oblong or globular and usually fleshy or berry-like, 3-carpeled but 1-loculed, the seeds being borne on parietal placentæ. The fruit is allied to the pepo of the Cucurbitaceæ. The ovary is supported on a long stalk which is inclosed in or usually united with the tube formed by the union of the bases of the filaments. The structure of the fruit is well shown in Fig. 1650; the remains of the floral envelopes have broken from the attachment on the torus and rest on the fruit. The petals are borne on the throat of the calyx, but in some species they are absent. Nearly or quite a dozen Passifloras are native to the U. S., and one of them, *P. lutea*, grows naturally as far north as southern Pa. and Illinois. From Virginia south, the Maypop, *P. incarnata*, is a very common plant in fields and waste places. Both these species are herbaceous perennials. The fruit of some Passifloras is edible.

In cultivation, the Passifloras have been considerably hybridized, and they are also confused with Tacsonia. In 1871 Masters enumerated 184 species (Trans. Linn. Soc. 27), and a number of species have been discovered since that time.

Most of the Passion-flowers are yellow or green in color of envelopes, but there are fine reds in *P. racemosa*, *P. Raddiana*, *P. coccinea*, *P. alata*, *P. vitifolia*, and two or three others.

L. H. B.

P. cærulea and Constance Elliott are both hardy at Washington. In summer time we use *P. fœtida* (raised from seed annually), and during the last two seasons, *P. Colimensis*, for trellis work. The last named is a good thing for this line of work; the fls. are white, purple center, about 2 in. in diameter; native of Mexico; very easy to prop. from cuttings of soft wood. Not many of the tender species and hybrids are grown to any great extent in this country. *P. alata* and *P. quadrangularis* are desirable climbers for a roomy, warm greenhouse. *P. quadrangularis*, var. *aucubifolia*, seems to flower quite as freely as the green-leaved one. Passifloras are prop. from cuttings of the half-ripened growth, with bottom heat. *P. racemosa* and *P. Loudoni* are a trifle difficult to root from cuttings; the growths should be as ripe as possible for this purpose. Keep the under surface of the leaves flat on the sand while rooting. The native *P. incarnata* grows very freely at Washington, becoming more or less of a weed and hard to eradicate.

G. W. Oliver.

INDEX.

A. *Corona with sharp folds, and crinkled at the edge.*

B. *Fls. apetalous, usually with no bracts.*

1. **grácilis,** Jacq. Slender annual: lvs. rather small, broadly deltoid-ovate, very shallowly and bluntly 3-lobed: fls. solitary, pale green or whitish, considerably surpassed by the lvs., the calyx-lobes oblong or lanceolate, the filiform rays of the corona in a single row and equal: seeds with 6 elevated ridges. Brazil. B.R. 11:870. —Fl. about 1 in. across. Easily grown either indoors or in the open, as a garden annual.

BB. *Fls. petaliferous, with large bracts.*

2. **adenópoda,** Moc. & Sess. (*P. acerifólia*, Cham. & Schlecht.). Lvs. glabrous, cordate, 3-nerved and 5-lobed, the lobes ovate-acuminate and somewhat serrate: bracts cut-serrate. Mex. to S. Amer.—Once advertised by Saul.

3. **Hähnii,** Mast. Tall, glabrous climber, with very slender terete branches: lvs. ovate, peltate at base, strongly 3-nerved and each of the side nerves ending in a tooth, but the leaf-margin otherwise entire but bearing minute red glands: stipules kidney-shaped, dentate, purplish, nearly or quite 1 in. across: fl.-bracts 2, entire: fl. about 3 in. across, solitary, whitish, the corona shorter than the envelopes, the outer filaments being orange. Mex. B.M. 7052. R.H. 1869, p. 430 (as *Disemma Hahnii*). G.C. II. 12:504.

BBB. *Fls. with minute petals and small linear distinct bracts.*

c. *Leaves oblong-ovate.*

4. **trifasciàta,** Lem. Lvs. 3-lobed to one-third or one-half their depth, the margins entire, with an irregular reddish purple band along each of the three midribs: fls. yellowish, fragrant, small. Brazil. I.H. 15:544.—Interesting for its ornamental foliage.

cc. *Leaves broader than long.*

5. **lùtea,** Linn. Herb, 5–10 ft. tall, glabrous: lvs. broader than long, shallowly 3-lobed, cordate at base:

fls. solitary, about ¾ in. across, greenish yellow: fr. a globular berry about ½ in. in diam. Pa. south and west. B.R. 1:79.—It has been offered by dealers in native plants.

AA. *Corona not crinkled or folded on the edge, plane or nearly so.*

B. *Bracts grown together.*

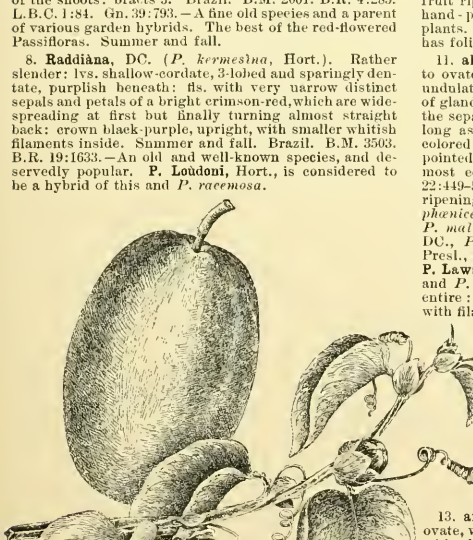
6. **igulàris,** Juss. (*P. Löwei,* Heer). Woody below, tall, branchy: lvs. large, cordate, ovate-acuminate, neither lobed nor toothed: fls. solitary, the petals and sepals greenish, the corona white, with zones of red-purple: fr. said to be the size of an orange. Trop. Amer. B.M. 2967.—Young foliage has metallic hues.

BB. *Bracts free.*

C. *Tube of flower evident and cylindrical, swollen at the base.*

7. **racemòsa,** Brot. (*P. princeps,* Hort. *P. amábilis,* Hort., in part). Lvs. glabrous, usually truncate at base, mostly deeply 3-lobed, the margins entire: fls. 4 in. or more across, the narrow petals deep red and wide-spreading, the short, upright crown purplish; calyx keeled on the lower side: fls. solitary, but the peduncles usually 2 from an axil, becoming racemose on the ends of the shoots: bracts 3. Brazil. B.M. 2001. B.R. 4:285. L.B.C. 1:84. Gn. 39:793.—A fine old species and a parent of various garden hybrids. The best of the red-flowered Passifloras. Summer and fall.

8. **Raddiàna,** DC. (*P. kermesìna,* Hort.). Rather slender: lvs. shallow-cordate, 3-lobed and sparingly dentate, purplish beneath: fls. with very narrow distinct sepals and petals of a bright crimson-red, which are wide-spreading at first but finally turning almost straight back: crown black-purple, upright, with smaller whitish filaments inside. Summer and fall. Brazil. B.M. 3503. B.R. 19:1633.—An old and well-known species, and deservedly popular. **P. Loùdoni,** Hort., is considered to be a hybrid of this and *P. racemosa.*



1651. Granadilla, Passiflora quadrangularis (×¼).

9. **Watsoniàna,** Masters. Stems wiry, purplish, with leafy dentate stipules: lvs. shallow-cordate, rather broader than long, 3-lobed to the middle, with a few teeth: peduncles 1-fld.: fls. about 3 in. across, the sepals linear and shaded with violet; petals also very narrow, lilac: crown of many rows of filaments, violet with bars of white below the middle, the inner and shorter set deep violet. Probably Brazilian. G.C. II. 26:648–9. I.H. 36:74. Gn. 33:638. A.F. 6:571.—Good grower.

CC. *Tube of flower very short, thick or fleshy in substance.*

D. *Stems and branches strongly 4-angled or even winged: lvs. simple.*

10. **quadrangulàris,** Linn. Granadilla. Fig. 1651. Tall strong climber, glabrous: lvs. ovate or round-ovate, cordate at base, mucronate, entire, the petiole with 2 or 3 pairs of glands: stipules large: fl. large (3 to 5 in. across) and interesting, fragrant, with ovate sepals and petals (the former white within and the latter reddish), the crown composed of 5 series of white-and-purple parti-colored filaments, of which the outermost exceed the floral envelopes: fr. oblong, 5–9 in. long, yellowish green, pulpy and edible. Tropical Amer. B.R. 1:14. Gn. 51, p. 313. R.H. 1898, p. 569. Gn. 59, pp. 4, 7.—Widely grown in the tropics, and variable, both as a vine and for its edible fruits. Frequeut in collections of economic plants in the North. It is a good climber for covering a greenhouse roof. Best results are secured if the temperature does not fall below 50°. The fruit ripens in summer. The fls. usually need to be hand-pollinated if fruit is wanted on house-grown plants. Var. **variegàta,** Hort. (*P. variegàta,* Hort.), has foliage blotched with yellow.

11. **alàta,** Dryand. Stem winged: lvs. glabrous, oval to ovate, somewhat cordate at base, the margin often undulate but otherwise entire, the petiole with 2 pairs of glands: fl. 3–4 in. across, very fragrant, the interior of the sepals and petals carmine; corona nearly or quite as long as the envelopes, the numerous filaments parti-colored with red, purple and white: fr. yellow, ovoid-pointed, about 5 in. long, very fragrant and one of the most edible. S. Amer. B.M. 66. G.C. III. 15:19; 22:449–51. R.B. 20, p. 104.—An excellent old species, ripening its fr. in midsummer. It is very variable. *P. phœnicea,* Lindl. (B.R. 19: 1603), *P. Brasiliensis,* Desf., *P. maliformis,* Flor., *P. oviformis,* Rœm., *P. latifolia,* DC., *P. Mauritiana,* Thouars, and *P. Mascarensis,* Presl., are all considered to be forms of this species. **P. Lawsoniàna,** Hort., not Mast., is a hybrid of *P. alata* and *P. racemosa:* lvs. oblong-oval, somewhat peltate, entire: fls. 3–4 in. across, brownish inside, the corona with filaments in several series.

12. **Decaisneàna,** Hort., is a hybrid of *P. quadrangularis* and *P. alata:* fls. bright carmine inside, about 4 in. across; corona as long as or longer than the envelopes, the more or less tortuous filaments banded with deep blue and white: lvs. bearing about 6 glands. R.H. 1855:281. F.S. 8:848.

DD. *Stems and branches terete, or at least not winged.*

E. *Leaves not lobed.*

13. **amábilis,** Hook. Stem slender and terete: lvs. ovate, very sharp-pointed, entire, rather thin, the petiole with about 2 pairs of glands: fl. solitary, about 3 in. across, the sepals and petals alike and bright brick-red within; corona or white filaments in 4 series, the 2 inner series being short. Brazil. B.M. 4406. Gn. 55:1219.

14. **laurifòlia,** Linn. (*P. tiniifòlia,* Juss.). Jamaica Honeysuckle. Water Lemon. Stem terete, plant glabrous: lvs. oval to oval-oblong, thickish, entire, with a short sharp point; petiole with 2 glands: fl. about 2¾ in. across, white, with red spots or blotches; corona somewhat exceeding the petals or at least about equaling them, in 3 series, violet with white bands: fr. about 3 in. long, yellow, spotted with white, edible. Trop. Amer. B.R. 1:13. B.M. 4958.

15. **coccínea,** Aubl. (*P. velùtina,* DC. *P. fúlgens,* Morr.). Glabrous: lvs. ovate and coarsely toothed; petioles with 2–3 pairs of glands: fl. scarlet; corona orange: fr. pulpy and edible. S. Amer. The fr. is said to contain "a chemical principle of hypnotic value."

EE. *Leaves 3–7-lobed.*

F. *Blossoms bright red.*

16. **vitifòlia,** HBK. (*P. sanguínea,* Smith. *P. pubéscens,* DC. *Tacsònia Buchánani,* Lem.). Stem terete: lvs. cordate-ovate in outline, deeply 3-lobed or divided and the divisions coarsely toothed, strong-veined, usually pubescent beneath: fl. 4–6 in. across, nearly flat, the linear-oblong sepals and petals bright scarlet, the sepals with a spine at the tip; outer corona filaments red, the inner ones white, all of them upright or spreading and much shorter than the envelopes. Brazil. F.M. 1878:317. G.C. III. 8:213.—An old species, but not common in cult. Said not to be free-flowering.

1652. Passiflora edulis (× ¼).

FF. *Blossoms white, greenish, purplish, or variously tinted, but not red.*

G. *Rays of corona (or the outer ones) about as long as the floral envelopes; leaf-margins strongly serrate (except sometimes in No. 19).*

17. **incarnàta,** Linn. MAY-POP. Fig. 1650. Tall-climbing strong vine, glabrous or nearly so: lvs 3-lobed to about half their depth, broadly cordate-ovate in outline, serrate, the petiole bearing 2 glands near the top: fl. axillary and solitary, about 2 in. across, white, with a light purple corona banded at its center: fr. oblong, about 2 in. long, with 3 sutures, yellow when ripe. Dry places, Va., south and west. B.M. 3697. Mn. 9:17.—A weedy plant, but offered by dealers in native plants. With protection, the roots will survive the winter as far north as Baltimore, and the strong herbaceous vines will make a fine cover for arbors and verandas. Easily grown from seeds.

18. **édulis,** Sims. Fig. 1652. More woody and stronger: lvs. large, deeply 3-lobed and serrate: fl. white, often tinted with purple, the rays nearly as long as the envelopes, white for the upper half but purple at the base: fr. globular-oblong, thickly purple-dotted when ripe, the rind hard. Brazil. B.M. 1989. R.H. 1857, p. 224; 1883, p. 489. Gn. 50:1093. G.C. III. 23:101. A.G. 13:120.—Runs into several forms. The fruit is fragrant and edible, but there is little pulp, the seeds occupying most of the interior. Readily grown from seeds. Naturalized in tropical countries.

19. **pruinòsa,** Mast. Climbing, the stems terete, glabrous: lvs, broad in outline, 3-lobed beyond the middle, the lateral lobes diverging, the margins remotely glandular-toothed, glaucous beneath: stipules very large and leaf-like, cordate, 2 in. long: fl. 3 in. across, pale or pearly violet, the corona of numerous filaments, the outermost of which are nearly as long as the petals and are deep violet at the base, yellowish in the middle and curly at the top. British Guiana. G.C. III. 22:393.—First described in 1897, and now offered in this country by Sander & Co.

GG. *Rays distinctly shorter than envelopes: leaf-margins nearly or quite entire.*

20. **álba,** Link & Otto. (*P. atomària,* Planch.). Stem terete: stipules very large and leaf-like: lvs. broad-ovate and somewhat cordate, rather shallowly 3-lobed, glaucous beneath, the margins entire: peduncles exceeding the lvs., 1-fld.: fl. little more than 2 in. across, clear white: fr. obovoid, the size of an egg, green at first, but becoming yellowish. Mex. to S. Amer. G.C. II. 19:693. R.H. 1883, p. 201; 1884:36.

21. **violàcea,** Vell. Tall, glabrous, with drooping branches: lvs. straight at base and somewhat peltate, with 3 long, narrow lobes, of which the side ones stand at nearly right angles to the central one, the margins entire or with a few teeth in the bottom of the sinus, the under surface slightly glaucous: fl. about 3 in. across, the petals and sepals lilac-pink inside (sepals ending in a long spur), the numerous filaments of the corona white-tipped and barred with violet and white. Brazil. B.M. 6997. R.H. 1885:468.

22. **cærùlea,** Linn. Fig. 1653. Slender, but a strong grower, glabrous and somewhat glaucous: lvs. divided nearly to the petiole into 5 lanceolate or lance-elliptic entire sharp-pointed segments of which the 2 lower ones are sometimes again lobed: fl. 3–4 in. across, slightly fragrant, greenish white, the sepals tipped with a short point, the rays of the corona in 2 series, blue at the tip, white in the middle and purple at the base, the styles light purple. Brazil. B.M. 28. Gn. 31, p. 421; 34, p. 114; 46, p. 369.—The commonest of Passion-flowers in American greenhouses, and now represented by several named forms and hybrids. Can be grown in the open in the South and in Calif. as far N. as San Francisco. Var. **grandiflòra,** Hort., is only a somewhat larger-fld. form. Constance Elliott (*P. cærulea,* var. *alba*), is a white-fld. fragrant form. Gn. 31:595. There are hybrids with *P. Raddiana, P. racemosa, P. alata,* and others. *P. cærulea* grows readily from seeds.

23. **alàto-cærùlea** (*P. Pfórdtii,* Hort.) is a white-fld. form, with calyx tinted rose inside, and corona of 3 series, the outer filaments being white at tip, blue-purple in the middle, and black-purple at the base. B.R. 10:848. R.H. 1847:121.

Passifloras in the Amer. trade, but not accounted for botanically, are: *P. cardinalis,* "scarlet flowers;" *P. Paraguayi,* Blanc, 1900; *P. Puxtoni; P. rosea; P. Schmittii,* "bright carmine." *P. insignis, Jamesoni, maniculata, Parritæ* are to be sought in Tacsonias.

Species which may be expected in the trade are: *P. chelidònea,* Mast. Lvs. oblong, forked at the end to one-fourth the length and with a small middle lobe, marked with dots: fl. 2 in. across, greenish, with a folded corona. Ecuador. G.C. II. 12:40.—*P. cinnabarina,* Lindl. Branches terete: lvs. broad-ovate, 3-lobed, margins entire: fl. solitary, 2½ in. across, red; corona short, folded, yellowish. Australia. G.C. 1855:724. B.M. 5911.—*P. Colimènsis,* Mast. & Rose. A Mexican species first described in 1899, but cult. for several years in Washington. It is an herbaceous species, with shallow-lobed obtuse denticulate lvs. and small whitish blue-marked fls. on single peduncles. Promising as an outdoor climber, p. 1220. —*P. fœtida,* Linn. (P. hirsuta and P. hircina, Hort.). Allied to P. adenopoda: annual or sometimes perennial: lvs. pubescent, 3-lobed, the margins entire or obscurely angled: fls. whitish, small, the corona as long as the petals and colored purple and blue: fl.-bracts pinnatifid. Trop. Amer. L.B.C. 2:136. B.M. 3635, the form known as var. nigelliflora, Mast.; and 288, the var. ciliata, Mast. In cult. in this country, but apparently not in the trade. Variable.—*P. galbàna,* Mast. Stems terete: lvs. lance-oblong, short-petioled, entire: stipules ovate-pointed: fl. solitary on a long peduncle, 3 in. across, greenish yellow, the sepals and petals very narrow, the not folded corona short. Brazil. G.C. III. 20:555.—*P. Im Thürnii,* Mast. Lvs. broad-oblong, acute, entire, thick, glabrous above, but not beneath: fl. erect, 4–5 in. across, brilliant scarlet and rose color, with white in the center; corona very short.

British Guiana. G.C. III. 23:307. Very showy.—*P. Kewénsis*, Hort. "It is a cross raised by Mr. Watson, the assistant curator, between the hardy Passiflora cærulea and the Brazilian P. Raddiana. The flowers are larger than those of P. Raddiana, the petals and fringe longer, while the color is carmine suffused with blue, which, though perhaps not so bright and pleasing as it is in the parent, is a lovely color."—*P. Miersii*, Mast. Stems slender and wiry: lvs. lance-ovate and entire, claret-colored beneath: fl. 2 in. across, white, shaded with pink, the corona half the length of the petals, white, barred with purple. Brazil. G.C. III. 4:353.—*P. triloba*, Ruiz & Pav. Lvs. large, cordate-ovate, 3-lobed or entire: fl. 3 in. across, with violet reflexed sepals and petals, and a long cup-like corona, with filaments banded white and purple. Peru. I.H. 36:83.—*P. Weberiana*, André. Glandular-hairy: lvs. large, 3-lobed, the margin usually toothed: fl. solitary, 2 in. across, white, the corona banded with white: fr. setose, purple. Argentina. R.H. 1887:324.

L. H. B.

PASSION FLOWER. See *Passiflora*.

PASTINÀCA (name from the Latin *pastus*, food). *Umbellíferæ*. About a half dozen species of tall herbs native to Europe and Asia, but by Bentham & Hooker united with the genus Peucedanum. It is distinguished from Heracleum and Peucedanum by technical characters of the fruit. Pastinaca is known to horticulturists in the Parsnip (which see), *P. sativa*, Linn. It is a native of Europe, but is now grown in nearly all cool-temperate countries for its large edible root. In deep moist soil and a cool climate, the edible roots become 18–20 inches long and four inches or more in diameter at the crown. It was cultivated before the Christian era. It has run wild from gardens, often becoming a bad weed in neglected fields and on roadsides. *P. sativa* is a robust plant, sending up a grooved stem (which becomes hollow) 3–5 ft.: lvs. odd-pinnate, with 3–4 pairs of sessile ovate-oblong sharp-toothed and notched leaflets, the terminal leaflet 3-lobed: fruit ("seed") thin and flat, retaining its vitality only a year or two. When run wild, it loses its thick root, and sometimes it becomes annual.

L. H. B.

PATCHOULI PLANT. See *Pogostemon*.

PATIENCE. Patience Dock or Herb Patience is *Rumex Patientia*.

PATRÍNIA (E. L. Patrin, 1742–1814, French traveler in Siberia). *Valerianàceæ*. About 10 species of yellow- or white-fld., valerian-like, hardy herbaceous perennials from extra-tropical Asia. They grow a foot or so high, bloom in early summer and may have about 20 small fls. in clusters 2 in. across. Two species are offered by dealers in Japanese plants.

Patrinia is distinguished from the other 8 genera in the Valerian family by 4 stamens and mostly yellow fls. Valeriana has 3 stamens. Nardostachys, with 4 stamens, has purple fls. Patrinias are glabrous or loosely villous: lvs. once or twice pinnatifid or -sect, the radical ones rarely entire: cymes corymbose-paniculed: bracts narrow, free, but sometimes appendaged with a large, 2-nerved and netted-veined bracteole which is appressed to the fr.: corolla-tube very short; lobes 5, spreading: sterile locules of the fruit nearly as large or larger than the fertile ones.

A. *Stem glabrous.*

scabiosæfòlia, Fisch. Radical lvs. ovate or oblong, incised-serrate and lyrate: cauline lvs. pinnatifid, the lobes lanceolate-linear, acute, terminal one longest: fls. yellow: corymb loosely subpaniculate: fr. 3-cornered. Dahuria. L.B.C. 14:1340.

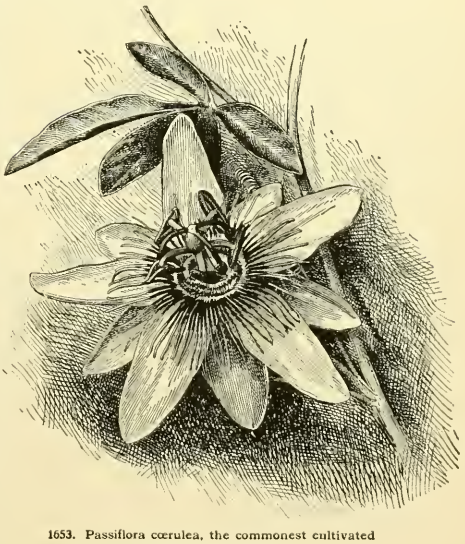
AA. *Stem villous.*

villòsa, Juss. Radical lvs. villous, petiolate, auricled: cauline lvs. sessile, dentate: corymb panicled. Japan. —The plant offered by the Yokohama Nursery Co. is said to have white fls.

PAULLÍNIA (probably after Simon Paulli, 1608–1680, professor of anatomy, surgery and botany at Copenhagen). *Sapindàceæ*. *P. thalictrifolia* is a handsome stove foliage plant, with much divided lvs. somewhat resembling a rue, maidenhair, or a davallia. The fls. are inconspicuous, pinkish and borne in autumn. In the early seventies, when the interest in foliage plants was at its height, this plant was widely distributed. It used to be trained to a trellis for exhibition or grown on the pillars and rafters of hothouses. It is now a rare but choice plant for clothing the tops of unsightly tubs in which palms are growing. G. W. Oliver says it is also excellent for large vases and stands the sun well. The young leaves have a pretty bronze tint unless they are shaded too much. The plant is prop. by cuttings of young shoots taken in early spring. If the tops are pinched the young plants will branch out and make handsome specimens in 4- or 5-in. pots. For potting soil an English gardener recommends compost of two-thirds fibrous peat to one-third of loam, with a liberal sprinkling of silver sand.

Paullinia is a genus of about 80 species, mostly tropical American. Twining shrubs: lvs. alternate, stipulate, compound, 1–3-ternate or pinnate, or decompound; petiole often winged; fls. usually dentate, dotted or minutely lined: racemes axillary, usually with 2 tendrils: sepals 5, the 2 upper larger, connate: petals 4, but there is a fifth abortive one: stamens 8: ovary 3-celled. Distinguished from allied genera, as Cardiospermum, by the septicidal fr., which is often pear-shaped.

thalictrifòlia, Juss. Lvs. 4–10 in. long, triangular in outline, 3-ternately-pinnate; pinnæ in 6–8 pairs; pinnules 4–8 pairs, 4–8 lines long. Brazil. B.M. 5879. Gn. 51, p. 160. F. 1873, p. 124. Var. **argéntea**, Hort., has foliage suffused silvery gray.



1653. Passiflora cærulea, the commonest cultivated Passion-flower (×⅔).

PAULÒWNIA (after Anna Paulowna, princess of the Netherlands). *Scrophulariàceæ*. Ornamental deciduous trees, in habit and foliage similar to Catalpa, with ample, long-petioled, opposite lvs., and pale violet large fls. resembling those of the foxglove in shape, in terminal panicles opening before the lvs. The species in cultivation is fairly hardy in sheltered positions as far north as Mass., but the fl.-buds are usually killed in winter, and it does not flower regularly north of New York city. As an ornamental foliage plant it may be grown as far north as Montreal, where it is killed to the ground every winter, but throws up from the root vigorous shoots attaining 10–14 ft., with lvs. over 1 ft. and occasionally even 2 ft. long. If used as a foliage plant and

cut back to the ground every spring, the young shoots should be removed, except one or very few on each plant; during the first years of this treatment they will grow more vigorous every year, but afterwards they will decrease in size, weakened by the continuous cutting back; they should then be replaced by strong young

1654. Paulownia imperialis.
To show the verdurous growth of the young shoots.

plants. Where the fl.-buds which are formed the previous year are not killed by frost the Paulownia is one of the most conspicuous flowering trees in spring, and in summer the foliage, though it is of somewhat dull color, attracts attention by the size of the lvs. In temperate climates it is sometimes used as an avenue tree. It thrives best in a light deep loam, and in a sheltered position. Prop. by seeds sown in spring or by root-cuttings, and by greenwood cuttings under glass; it may be grown also from leaf-cuttings; the young unfolding lvs. when about 1 in. long are cut off close to the stems and inserted in sand under a hand-glass in the propagating house. Two species in China and Japan: a third one with evergreen foliage is reported by Dr. Henry from South China and pronounced one of the most magnificent flowering trees. Trees with stout spreading branches: fls. in terminal panicles; calyx campanulate, 5-lobed; corolla with long, slightly curved tube, and spreading, oblique 5-lobed limb; stamens 4: fr. a 2-celled capsule, loculicidally dehiscent, with numerous small winged seeds.

imperiàlis, Sieb. & Zucc. (*P. tomentòsa*, Stend.). Fig. 1654. Tree, to 40 ft., with stout spreading branches forming a round head: lvs. rather long-petioled, broadly cordate-ovate, entire or sometimes 3-lobed, acuminate, pubescent above, tomentose beneath, 5–8 in. long or on vigorous shoots even larger; panicles to 10 in. long: fls. fragrant, pale violet, 1½–2 in. long; pedicels and calyx densely rusty tomentose: capsule woody, broadly ovoid, pointed, 1 in. or somewhat longer. April, May. China, Japan. S.Z. 1:10. B.M. 4666. P.M. 10:7. Gn. 34, p. 79; 54, p. 476. Mn. 7, p. 171. It is sometimes escaped from cult. in the S. States.

ALFRED REHDER.

Paulownia imperialis in southern California reaches a height of 40 ft. in 25 years, with a spread nearly as great. When in full leaf it makes a dense shade. It starts to bloom before the leaves come and all is over before the tree is in full leaf. For this reason it is not a favorite. The Jacaranda is a prettier blue, more floriferous, lasts three times as long, the blooms continuing until the tree is in full leaf. It is out of leaf not more than half as long as Paulownia is. It makes as dense shade as the Paulownia, has a prettier leaf and is more desirable in every way. The growth of the two trees is about the same at the end of a quarter century. The habit of the Paulownia in retaining dry seed-pods on dead limbs 3 or 4 ft. long is very unpleasing, and necessitates a thorough cleaning each year to the tip end of the uppermost branch—often a hard work to accomplish.

ERNEST BRAUNTON.

PAVÉTTA (Malabar name of *P. Indica*). *Rubiàceæ*. About 60 species of tropical shrubs and small trees closely allied to the brilliant Ixoras but far less showy, the fls. smaller, and the clusters looser; also they have a much more conspicuous style, which is often thrust out of the flower an inch or so. The fls. are white or greenish, salver-shaped, 4-lobed (rarely 5-lobed), and borne in trichotomous corymbs, containing as many as 30 fls., which at best may be 1 in. long and ½ in. across. Pavettas generally have membranaceous lvs., while those of Ixora are leathery. In Pavetta the style is longer and spindle-shaped at the top; in Ixora the style generally has 2 short branches at the top. Other generic characters of Pavetta are: calyx-lobes short or long: stamens 4 or 5, barely exerted: disk tumid, fleshy: ovary 2-locular: drupe 2-stoned.

A. *Foliage variegated.*

Borbónica, Hort. Foliage plant with unknown fls. Its position in this genus is a mere guess. Lvs. about 9 in. long, oblong-acuminate, rounded at the base, with a salmon-red midrib, mottled with light green on a dark green ground. Bourbon Island. Lowe 5.

AA. *Foliage not variegated.*

Natalénsis, Sond. Lvs. lanceolate-acuminate, petiolate, glabrous: calyx-teeth bristle-shaped, thrice as long as the calyx-tube: fls. white. Natal.

P. Cáfra, Haw. & Sond. Lvs. obovate, almost sessile, glabrous: calyx-teeth twice as long as the tube: fls. white. S. Afr. B.M. 3580.—*P. Indica*, Linn. Glabrous to tomentose: lvs. varying greatly in shape: calyx-teeth much shorter than the tube: fls. white. India. B.R. 3:198.

W. M.

PÀVIA. Included with *Æsculus*.

PAVÒNIA (J. Pavon, joint author of Ruiz and Pavon's Flora Peruviana et Chilensis; died 1844). *Malvàceæ*. About 60 species of tropical herbs or shrubs, tomentose, hispid or glabrescent: lvs. often angled or lobed: fls. of various colors, peduncled or crowded into a sort of head at the tips of the branches: bractlets 5-many, distinct or more or less connate; calyx 5-cut or 5-toothed; petals spreading or convolute-connivent: staminal column truncate below the apex or 5-dentate: ovary 5-loculed, 1-ovuled.

Perhaps the most desirable species is *P. multiflora*, known to gardeners as *P. Wioti*. This has many showy

1655. Pavonia intermedia (×⅔).

Garden Peas (Nott Excelsior and American Wonder)

red bractlets, which are linear, erect, hairy, whorled, and nearly 2 in. long. Within the cup-shaped group of bractlets lies a cartridge-shaped mass of dull brown, tightly rolled petals. From the body of petals protrudes the staminal column, which may be 3 in. long and bears numerous violet-blue anthers.

1656. Pea, American Wonder (× 1-5).

The illustration shows an entire plant, cut off at the surface of the ground.

P. Makoyana, Morr., of the trade, is **Gœthea Makoyàna**, Hook., B.M. 6427, a Brazilian plant with a dark purple mass of petals set off by about 5 large, broad, showy red bractlets. The only difference between Pavonia and Gœthea lies in the bractlets, which are narrow in the former and broad in the latter.

P. intermedia, St. Hil., Fig. 1655, is a Brazilian plant int. by the U. S. Dept. of Agric. for economic reasons. Its bractlets are intermediate in breadth between the two genera Pavonia and Gœthea.

multiflòra, A. St. Hil. (*P. Wioti*, E. Morr.). Robust, probably shrubby, usually with a simple stem: lvs. alternate, 6–10 in. x 1½–2 in., obovate-lanceolate, serrulate: fls. in a short, terminal corymb. Brazil. B.M. 6398. F. M. 1877:276. W. M.

PAWPAW. *Asimina* and *Carica Papaya*.

PEA. The garden Pea is the most important member of the genus Pisum (which see). It is native to Europe, but has been cultivated from before the Christian era for the rich seeds. The field or stock Pea differs little from the garden Pea except in its violet rather than white flowers and its small gray seeds. There are many varieties and several well-marked races of garden Peas. Whilst Peas are grown mostly for their seeds, there is a race in which the thick, soft green pods, with the inclosed seeds, are eaten. The common or shelling Peas may be separated into two classes on the character of the seed itself,—those with smooth seeds and those with wrinkled seeds. The latter are the richer, but they are more likely to decay in wet, cold ground, and therefore are not so well adapted to very early planting. Peas may also be classified as climbing, half-dwarf or showing a tendency to climb and doing best when support is provided, and dwarf or those not requiring support. Again, the varieties may be classified as to season,—early, second-early, and late; examples of these classes are shown in the pictures, 1656, 1657, 1658, respectively.

Vilmorin's classification (Les Plantes Potagères) is as follows:

A. The Pea round (smooth).
B. Plant climbing.
c. Seed white.
cc. Seed green.
BB. Plant half-dwarf.
c. Seed white.
cc. Seed green.
BBB. Plant dwarf.
c. Seed white.
cc. Seed green.
AA. The Pea wrinkled (divisions as above).

The Chinese gardeners about New York city grow a Pea which is described as follows by the writer in Bull. 67, Cornell Exp. Sta.: "The Pea (*Ga-lon-ow*) of the Chinese gardens behaves like a little improved or perhaps ancient type of the common Pea. It is the same species as ours. It differs chiefly in having somewhat knotty or constricted pods, as shown in the illustration (Fig. 1659). The pods 'shell' very hard, and there is a tendency to develop a broad border or margin along the lower side. The Peas are small and are variable in color, and they generally turn dark in cooking. In quality they are sweet and excellent, but they do not possess any superiority over our common varieties. The seeds which we have obtained from the New York Chinamen are mixed. In color, the Peas run from nearly white to dark brown. The brown seeds, however, have given us much earlier pickings than the light ones. In one instance the seeds were sorted into three grades—light, medium light, and dark brown—and all were planted in sandy soil on the 20th of April. On the 5th of July the dark-seeded plot gave a good picking, while the light-seeded, and even the medium plots produced much taller plants and very few of the pods had begun to fill. The dark- and medium-seeded plots produced plants with colored flowers—the standard being rose-purple and the keel black-purple and splashed. The light-colored seeds, on the other hand, gave pure white flowers, larger leaves and broader pods. These facts are interesting in connection with the evolution of the garden Pea and its relationship to the red-flowered field Pea."

Left to themselves, the varieties of Peas soon lose their characteristics through variation. They are much

1657. Pea, Nott Excelsior (× ½).

influenced by soil and other local conditions. Therefore, many of the varieties are only minor strains of some leading type, and are not distinct enough to be

recognized by printed descriptions. This accounts for the confusion in varieties of Peas, particularly in the dwarf or extra-early types. The varietal names are many. In 1889 (Annals Hort.) American dealers catalogued 154 names. L. H. B.

1. *Peas for the Home Garden.* — Green Peas are at their best when perfectly fresh, and should come to the table within 5 or 6 hours from the vine. Those bought in the market can rarely be served until 24–48 hours

1658. Pea, Champion of England ($\times \frac{1}{4}$).

after picking, when they necessarily have lost much of their good quality. It is, therefore, a great advantage to have a home-grown supply. Though they are of easy culture, it is not always feasible to give them a place in one's own garden, because they require considerable space, 1–2 yards of row being necessary to produce a single "portion," and it is rare that more than 2 or 3 pickings can be made from the same vines. Peas need a rich, friable soil, but an over-supply of nitrogen or the use of coarse and fresh manure will result in a rank growth of vines, with few pods and Peas of inferior quality. The best manurial condition for Peas is found where a heavy dressing of fertilizer has been applied the previous year. If such a soil is not available, the application of 3–6 bushels of well-rotted stable manure, or, in place of this, about one-half bushel of wood ashes, 3 or 4 pounds of salt and 5–10 pounds of ground bone or other commercial fertilizer to the square rod, and well worked into the surface soil just before planting, will give good results. Most of the cultivation for Peas should be done before they are planted, and it is more important for this crop than for most that the ground should be well worked and made as friable as possible before the seed is sown. While Pea vines will be killed by a hard freeze, they will endure a slight frost with but little injury, and thrive best in a cool, damp soil and atmosphere. It is, therefore, desirable to plant as early in the spring as the soil can be worked. The writer likes best to plant in double rows about 6 inches apart, with the distance between the pairs about equal to the height to which the variety grows. If the soil is sandy and well drained, form a trench 4–6 inches deep and drop 10–20 seeds to the foot according as the variety is a tall- or dwarf-growing one, and cover about an inch deep, gradually filling the trench as the plants grow. In proportion as the soil is heavier and less porous and well-drained the trench should be shallower until, on tenacious clay soils, the seed should be within an inch of the surface.

All the garden varieties, if planted in the way suggested, will give a fair return without trellising, but those growing over 2 feet high will do better if supported. There is nothing better for this purpose than brush, but this is not always available, and the vines can be well supported by driving stakes 2–4 inches wide 12–20 feet apart in the double rows, and as the vines grow inclosing their tops between wires or wool twine stretched opposite each other on either side of the stakes.

Anything more than mere surface tillage is apt to do the Pea crop more harm than good, but any crust formed after rain should be broken up, and the vines will be greatly benefited by frequent stirring of the surface soil.

2. *Peas for Market.* — The above notes will suggest the best methods of culture for market, and profit will depend largely upon the selection of varieties suited to the needs of the trade, and the use of pure and well-grown seed.

3. *Peas for Canning.* — The quantity of Peas canned, and the popularity of such goods, has been largely increased by the use of the machines known as viners, in the use of which the vines are cut when the green Peas are in the best condition for use, and fed into the machine, which by a system of revolving beaters and cylinders separates the green Peas as effectually as a threshing machine does those which are ripe and dry. As the vines will begin to heat and spoil within a few hours after cutting, it becomes essential to get them through the viner and the Peas into the cans the same day they are gathered, and the canned Peas come to the table fresher and better in quality than from most of the pods obtainable in market. When grown for canning or for seed, Peas are usually sown broadcast or with grain drills and no farther culture given, though the crop is improved by a judicious use of the roller after sowing and a weeding harrow just after the plants are up.

4. *Varieties and the Growing of Seed.* — There are few vegetables in regard to which there is greater difference in tastes as to desirable qualities. To some people tenderness is the most essential quality; to others sweetness, while still others care most for a rich flavor and marrow-like texture. Varieties have been developed to meet all these wants, as well as those varying in growth from 6 inches to 6 feet in height and of great diversity in the size, form and color of the pods. In this vegetable the quality and purity of the seed used is of great importance, for every "mess" of Peas consists of the product of many seeds, and as the pods are so near alike that it is impracticable to separate them in gathering, the product of a single inferior seed may injure the entire picking. Again, Peas grown for seed return a very small fold, very rarely as much as 20 and more often less than 5 times the seed planted; so that it is impracticable for the seedsman to offer his customers seed grown direct from the seed of individually selected plants, as can readily be done in the case of tomato,

1659. Pea grown by the Chinese gardeners in the neighborhood of New York City ($\times \frac{1}{3}$).

squash or other vegetables, which give a larger seed return. The most that can be done is to use the greatest pains to keep the varieties pure and of high quality by constantly renewing stocks by selection and the preventing of deterioration or mixing while growing and handling. With none of our common vegetables is the

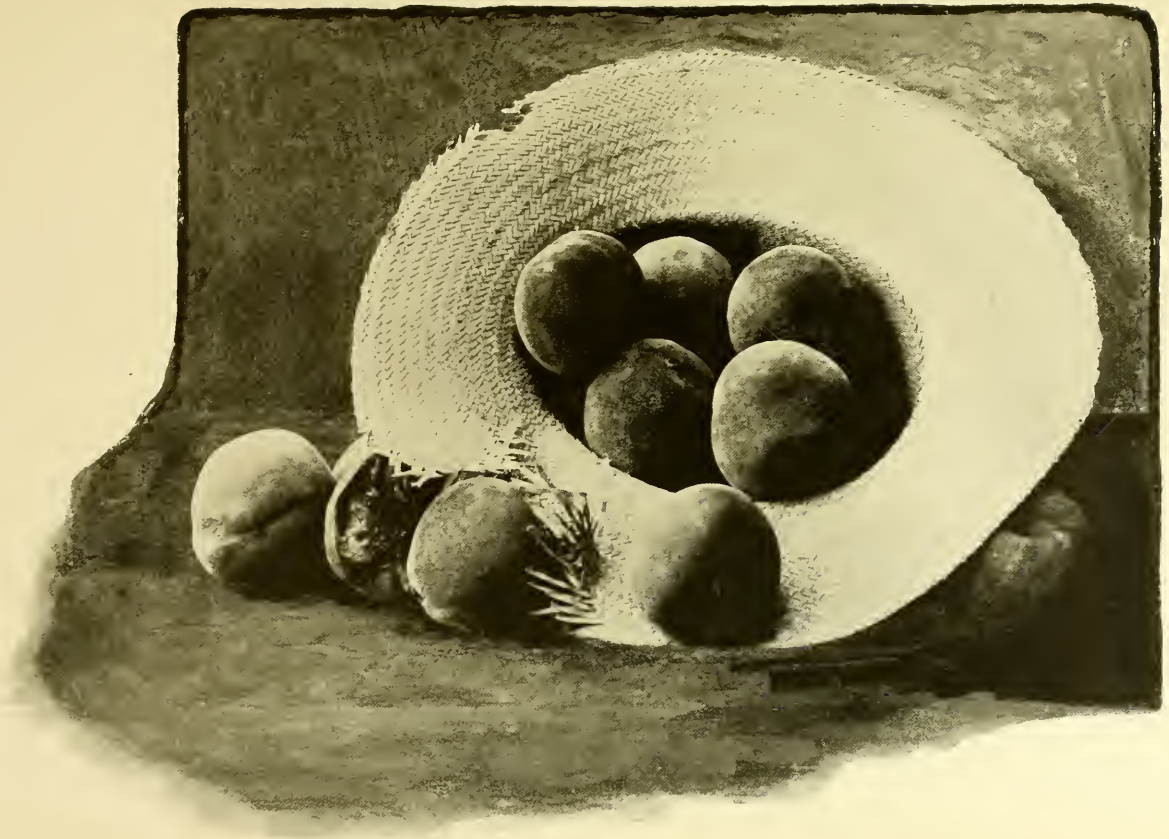


Plate XXVI. Peaches of the common Persian race.—The Crosby variety (about one-third natural size)

planter more dependent upon the ability and honesty of his seedsman.

Some of the most distinct types of the hundreds of varieties of garden Peas are:

(1) The earliest kinds, such as Alaska and First and Best, which produce early-maturing, comparatively small pods filled with Peas of rather low quality, on vines about 2 feet high.

(2) A long list of dwarf-growing sorts like American Wonder (Fig. 1656) and Premium Gem, which produce small- or medium-sized pods generally crowded with Peas of fine quality on vines ranging from 6–18 inches in height.

(3) A large class like Strategem and Heroine, which produce very large pods containing large, rich-flavored Peas on thick, heavy vines growing 18–30 inches high.

(4) Lastly, there are the taller growing sorts, like Telephone and Champion of England (Fig. 1658), which yield large crops of large- or medium-sized pods on vines growing from 4–6 feet high.

In addition to the above-named sorts grown exclusively for use as green Peas, there are a number of kinds with hardy, vigorous, tall-growing and usually branched vines which produce in great abundance smooth, hard Peas which are used when ripe for split Peas or other form of "soup stocks" or for stock-feeding; though some of them, like the Marrowfats and the "Turkey" or French Canner, are quite extensively used for canning, most of the celebrated Petit Pois of France being put up from the last-named variety. In field culture for stock the ground should be made ready in the fall and the surface simply "fined" with a cultivator, disk or gang plow in the spring. As early as the surface can be got into good condition sow broadcast, carefully covering with a gang plow or disk harrow, from 1½ to 3 bushels of seed to the acre, according to the variety used; or they can be put in rows better with an ordinary grain drill, provided it be of a pattern with the feed so arranged that it will not crack the Peas, many a poor stand being due to the seed being injured by the drill. It is generally an advantage to roll after sowing, and in some cases a weeding harrow can be used to advantage when the plants are an inch or two high. The crops should be harvested before the vines are so ripe that the Peas will waste by shelling, and it can be done by pea harvesters, which are attachments to ordinary mowing machines, or cut and "rolled" into windrows or bunches with a short scythe. They are easily threshed. The ordinary yield is from 20 to 50 bushels to the acre.

W. W. Tracy.

PEA, Everlasting P., *Lathyrus latifolius.* **Glory P.,** *Clianthus Dampieri.* **Hoary P., Pigeon P.,** *Cajanus Indicus.* **Scurfy P.,** *Psoralea.* **Sweet P.,** *Lathyrus odoratus* and *Sweet Pea.*

PEACH. Plate XXVI. The Peach is essentially a luxury. Its cultivation is attended with much risk. The areas in which it can be grown with success are scattered, particularly in the northern states. The Peach is tender to frost, and the liability of the buds and blossoms to injury constitute the greatest risk in the growing of the fruit. Strangely enough these risks of frost are greater in the South than in the North, because the buds are likely to be swollen by the "warm spells" of the southern winter, and to be killed by sudden freezes. In the northeastern states the Peach areas are determined chiefly by mildness of winter temperature. They lie near large bodies of water, in which places the temperature is considerably ameliorated. In close proximity to the seacoast the winds are usually too strong to allow of the growing of Peaches, but some distance inland and on the margins of the Great Lakes and other interior bodies of water, the fruit may be grown without difficulty. While Peaches are grown over a very large range of country in the United States, still the great commercial regions are relatively few. One of these regions lies in proximity to the southernmost members of the Great Lakes, particularly along the southeastern part of Lake Ontario in New York and Canada, along the southern shore of Lake Erie and on the eastern shore of Lake Michigan. In this latter belt, known as the Michigan "fruit belt," the Peach reaches its highest northern limit in the eastern states, being grown with profit as far north as Grand Traverse, on the 44th parallel. Another large area begins near Long Island Sound, in Connecticut, and follows the seaboard as far south as the southern part of the Chesapeake peninsula and extending approximately one hundred miles inland. In the southern Atlantic states there is another commercial Peach area, comprising the upper lands of Georgia, Alabama and adjacent states. Farther south than this, where the soil does not freeze to the depth of the roots, the root-knot disease, caused by a nematode worm, is so serious as often to interfere with the raising of the crop. In this southern part, also, the old-time varieties of Peaches do not thrive to perfection, but some of the Chinese types are now giving good satisfaction. Another large Peach-growing area lies in southern Illinois, extending westward across Missouri and into Kansas. Eastern Texas has also developed a large commercial peach-growing business. Part of western Colorado is now becoming known as a peach country. Nearly the whole of California, except the mountains, is admirably adapted to the Peach, and the fruit is grown there on a large basis. There are isolated places all over the United States in which Peach growing is profitable, but the above outline designates the areas of largest commercial importance at the present time.

In regions that are too cold for the normal development of the Peach, the tree may be grown with some satisfaction by laying it down in winter. For this purpose the tree is usually trained with a thin or rather flat top so that it will lie upon the ground when the tree is bent over. When the tree is to be laid down, earth is dug away from the roots on one side, the ball of earth which holds the roots is loosened somewhat, and the tree is bent over until it reaches nearly or quite the level of the ground. It may remain in this position without covering, being protected by its proximity to the earth and by the snow which drifts into the top; or sometimes the tree is covered with litter or even with earth,—if with litter, care must be taken that mice do not nest therein and gnaw the trees.

Although the Peach has many forms, it is all one species, *Prunus Persica.* See *Prunus.* It is probably native to China, but it has been in cultivation from the earliest times, and it came into Europe by way of Persia, whence the name *Persica,* and also *Peach.* From this Persian-European source have come the common Peaches of the United States. These Peaches do not thrive well in the extreme south, however. In more recent years introductions have been made directly from China, and these types, of which the Honey (Fig. 1661) is the chief example, thrive well in the far south. Still another type of Peach, which is hardy and productive in the South, is the Indian type sometimes called the "native peach." This is probably derived from the Peaches which the early Spaniards brought into North America. It has run wild over a wide range of country in the South. As early as 1812 the botanist Nuttall found Peaches growing wild as far west as Arkansas. Still another type of Peach is the Peen-to, or the flat Peach of China. This is adapted only to the extreme southern part of the country, thriving well in the northern part of the citrous belt. It is much too early-blooming for even the middle south. It is a very early Peach, much flattened endwise, so that it has the shape of a very flat apple. (Fig. 1660.) It has been described as a distinct species, *Prunus platycarpa,* but there is every reason to believe that it is only a modified form of the ordinary Peach species. Price (Bulletin 39, Texas Experiment Station) divides all Peaches which are known in North America into five general groups: (1) The Peen-to or flat Peach race, comprising the variety known as the Peen-to (Fig. 1660), and also the Angel and Waldo; (2) the South China race, with oval, long-pointed fruit with deep suture near the base, represented by the Honey (Fig. 1661); (3) the Spanish or Indian race, with very late, yellow, firm, often streaked fruit, represented by various southern varieties, as the Cabler (Fig. 1662), Columbia, Galveston, Lulu, Texas and Victoria; (4) the North China race, with large, mostly cling or semi-cling fruit and very large, flat leaves, represented by the Chinese Cling, Elberta (Fig. 1663), Mamie Ross, Smock and Thurber; (5) the Persian race, including the common varieties of the mid-country and the North,

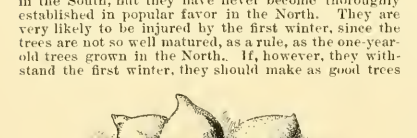
as Crawford (Fig. 1664), Oldmixon, Salway, and the like. The varieties of Peaches are many, although less numerous than those of apples. An inventory of 73 catalogues of American nurserymen, in 1900, showed 291 varieties on the market.

The Peach is a showy tree when in bloom. There are double-flowered varieties (Fig. 1665), which are as

1660. Peen-to Peach (× ½).

handsome as the dwarf flowering almond, and they are more showy because of the greater size of the tree. These double-flowered varieties have never become popular, however, owing to risks of winter injury and spring frosts, depredation of borers, and the short season in which they remain in bloom. The flowers of the Peach are naturally variable in both size and color. Peach-growers are aware that there are small-flowered and large-flowered varieties. The character of the flower is as characteristic of the variety as size or color of fruit is. Fig. 1666 shows two extremes. The Crawfords are small-flowered; the Alexander and Amsden are large flowered.

Propagation.—The Peach is always propagated by means of seeds. The first year the seedlings are budded to the desired variety. The seed is planted on the first opening of spring in rows far enough apart to allow of horse tillage, and the seeds are dropped every 6 to 8 inches in the row. These seeds should have been kept moist during the winter. Usually they are piled out of doors, being mixed with sand or gravel, and allowed to freeze. The shells are then soft when planting time arrives and many of the pits will be split. Then it will not be necessary to crack the pits. In the northern states the trees will be ready for budding in August and early September. The buds are set close to the surface of the ground, and they do not start until the following spring. The year succeeding the budding, the bud should make a tree 3 to 6 feet in height, and at the end of that season it is ready for sale; that is, the tree is sold when it is one season from the bud. In the southern states, Peach seedlings may be large enough to bud in June or early July of the year in which the seeds are sown. The buds will then grow that season, and the trees be ready for sale that fall. That is, the whole process is completed within the space of one season. These "June-budded trees" are popular in the South, but they have never become thoroughly established in popular favor in the North. They are very likely to be injured by the first winter, since the trees are not so well matured, as a rule, as the one-year-old trees grown in the North. If, however, they withstand the first winter, they should make as good trees



1661. Honey Peach (× ¾).

as others. For the details of propagation, see the article on *Grattage* in Vol. II.

Soil and Planting.—The Peach will thrive on most any soil, providing the climate and site are congenial. The best Peach land, however, is that which is light and sandy. On such lands the Peach develops its highest color and its richest flavor, although on heavier lands it may be more juicy. The soil in the great Peach sections of Michigan and the North Atlantic region is light and loose. On heavy lands the Peach is likely to grow too late in the fall and to make too much wood. The fruit is usually somewhat lower in color and tends to be later in ripening. The low color may be corrected, however, by planting the trees far apart, and by pruning to open tops to admit the sun.

Since the Peach blooms very early and the flowers are liable to be killed by late spring frosts, it is important that the site on which the orchard is planted should either be relatively free from late spring frosts or such as to retard the bloom. In proximity to large bodies of water, late spring frosts are less likely to occur, and the tree blooms relatively late because the water equalizes the climate and adjacent areas do not warm up so quickly in the spring. This is particularly true along such large bodies of water as the Great Lakes. In interior places it is well to choose a northern slope or other backward site, on which place the trees are retarded in bloom. In warm exposures in cities Peaches are very likely to be caught by late spring frosts because they bloom too early. It is usually better in such cases to plant the trees on the north side of a building.

Peach trees are always set when not more than one year from the bud. The distance apart varies with dif-

1662. Cabler Peach (× ½).

ferent soils, different parts of the country and with different growers. The standard and maximum distance is twenty feet apart each way. If trees are planted at this distance, they may be tilled with ease, and heading-in may not be necessary. Many growers, however, plant closer than this with excellent results. By giving extra good tillage and fertilizing they force trees to bear young, and by the time the trees begin to crowd the orchard has paid for itself, and some of the trees may be removed. Whilst this practice may be advised in special cases, the case depending on the energy and ability of the owner, it is not to be advised for general purposes.

Tilling and Fertilizing.—Having selected his land, the Peach-grower must look with the greatest care to the cultivation and fertilizing of the orchard. Peach orchards should not be cropped after the third year; and if they are planted on sandy lands, and particularly if set less than 20 feet apart, they should not be cropped from the time they are set. Very frequent stirring of the surface soil from May until August, and thereafter, perhaps, a green crop which shall be plowed under the next spring, is the best general plan of tillage. Never seed down a Peach orchard nor sow it to grain. If there is any fruit that should never be neglected, it is the Peach; and this is why careless men do not succeed with it, and why so many of the orchards produce only debts and discouragement. But it is easy to produce an overgrowth on strong lands. The trees grow to a great size during the first few years, their tops are full of heavy leaves and the foliage holds very late in the fall. These trees generally bear tardily and in some cases they are not productive. They run to wood. The winds tear them to pieces. The trouble lies first in the land:

it is too strong for the Peach. The second trouble may be the too free use of barn manures or other nitrogenous fertilizers, or too late tillage in the fall.

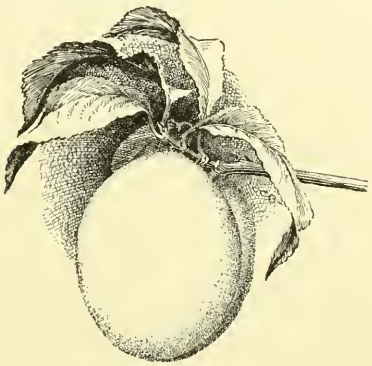
The keynote to the proper fertilizing of Peach orchards is liberal use of potash and phosphoric acid and sparing use of nitrogen. Ashes, muriate of potash, bone fertilizers,—these are some of the best fertilizers for Peach trees. Tillage, with green manure crops at the end of the season, can be relied upon to furnish the nitrogen in most instances; and it is even possible to plow under too much vetch or crimson clover in the course of years. Peaches which overgrow are likely to suffer in winter.

Pruning Peach Trees.—The methods of pruning Peach trees are the occasion of much discussion amongst pomologists. The differences of opinion turn chiefly about three practices,—short trunks with rapidly ascending branches; high trunks with more horizontal branches; and shortening-in or heading-back the annual growth. Each of these three methods has ardent advocates and opponents. It is probable that each system has distinct merits for particular cases. The nature and fertility of the soil are often the dominating factors in these opposing methods. A system of pruning which fits the slow growth and hard wood of sandy soils may not be adapted to the rapid growth and heavier tops of trees on strong soils. Fig. 1667 shows what is believed to be, in general, the best method of pruning Peach trees on sandy or what may be called Peach soils. It is the natural method. The tree is allowed to spread its top at will, with no heading-in. The foliage is comparatively light and does not place great weight upon the branches, and the trees, on such lands, do not grow quickly to such great size as on heavy lands. This method of allowing a tree to make its natural top is the common one in the Chesapeake peninsula (Fig. 1668) and in the Michigan Peach belt (Fig. 1669). It will be observed, also, that the pictures show trees with short trunks and forking branches. It is a prevalent opinion that such trees are more likely to split with loads of fruit than those which have more horizontal branches, but this is an error. Of course, much care should be exercised to see that the branches do not start off from the trunk at exactly the same height, thus making a true fork or Y. With this precaution, the crotchy trees are no more likely to split than the others, while they allow of a much better form of top, unless the tree is to be headed-in. The horizontal branches of the high-topped trees often appear to carry a load of fruit with less ease than the more upright branches of the other style of training. This danger of breaking is greatly lessened if the fruit is properly thinned. The low trunk permits a more open top, and this seems to be an advantage. One is often surprised at the thinness of top in the best Peach orchards of Michigan and Delaware. In such tops, the Peach should color better, and it is reasonable to expect less trouble from fungi.

Yet there is much to be said for the high-topped trees. They are more easy to till and it is quite as easy to pick their fruit; and there is less tendency to make long and sprawling branches as a result of careless pruning. On rich lands, it is perhaps the better method. And here is the chief reason for heading-back in the North,—the necessity of checking the growth and keeping the tree within bounds when it is growing in a strong soil. Whether one shall head-in his trees or not, therefore, must depend on circumstances. In sandy Peach lands it is generally unnecessary, but it may be a good practice when trees make an over-exuberant growth. This heading-in is usually done in the winter, from a third to half the annual growth being removed.

Heading-in the branches always tends to make a thick-topped tree. The best growers usually give much attention to cutting out the small unprofitable wood from the center of the tree (compare Figs. 1670, 1671). This labor may be greatly increased if heading-in is practiced. If not persistently thinned of the inner growths, headed-in trees tend to produce fruits of lighter color and of later ripening. Many orchards have suffered from twig-blight in these central shoots.

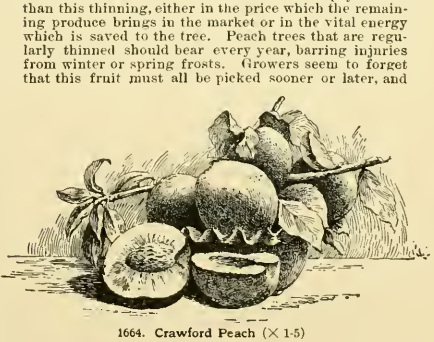
The pruning may be made a thinning process. The fruit of the Peach is borne on the wood of the previous year. The Peach makes true flower-buds,—those containing no leaves. Two flower-buds are borne together as a rule, on either side of a leaf-bud. These buds often show plainly as early as August, or even earlier. At that time the position of some of the fruit-buds may be distinguished by the triple leaves (Fig. 1672). When



1663. Elberta Peach (× nearly ½).

the leaves have fallen, the twin fruit-buds, with the leaf-bud between, present the appearance shown in Fig. 1673. Not always do the two buds develop: one of them may be aborted or injured so that a single flower-bud and a leaf-bud stand together. These flower-buds are borne on both the strong terminal shoots and on the weak growths in the interior of the tree top. The fruits in the interior of the top are for the most part poor; therefore it is good practice to remove the weak shoots on the inside of the top, thereby thinning the fruit and allowing the energy of the tree to go to the development of the fruit nearer the ontside. Any system of pruning, therefore, which removes the annual growth thins the fruit. Heading-back the tree also may be a thinning process. The fruit-buds are borne some distance below the tips of the shoots, however, and unless the heading-in process is somewhat severe, there is little result in thinning the fruit.

Thinning the Fruit.—There is very general neglect in thinning the fruit. It should be a rule that no two Peaches should stand closer on the same branch than five or six inches. No work of the orchard pays better than this thinning, either in the price which the remaining produce brings in the market or in the vital energy which is saved to the tree. Peach trees that are regularly thinned should bear every year, barring injuries from winter or spring frosts. Growers seem to forget that this fruit must all be picked sooner or later, and



1664. Crawford Peach (× 1-5)

that the work is more easily done in June or July than in September. The thinning should be delayed until the fruit is the size of the end of one's thumb, for by this time the "June drop" has occurred, and the

Peaches can be readily seen and handled. The fruit from well-thinned trees usually sells for twice as much as that from overloaded trees, and the vigor of the trees is conserved at the same time; and the grower has the satisfaction of selling a superior product. There are two rules for the workman to observe in the thinning of fruit: (1) removal of injured or inferior fruits; (2) allow no two fruits to stand closer together than the distance which has been decided on—say about six inches for Peaches.

Marketing.—If growers are negligent in thinning the fruit, they are too often positively careless in marketing it. Even in years of low prices, honestly and tastefully packed fruit brings good prices. The handsome boxes of California Peaches, containing 60 wrapped fruits, will sell readily for $2 to $4, whilst home-grown fruit sells for 25 to 75 cents a half bushel; and yet the latter may be the better by the time it reaches the consumer.

There are several faults with common methods of handling Peaches. The packages are too large. The fruit is not graded and selected; in fact, it is not well grown. There are often no wooden covers on the baskets, and, as a consequence, that part of the package

1665. Bloom of double-flowered Peach (× ½).

1666. Bloom of large- and small-flowered Peaches. (× ⅓.)

which should look the best is usually the most jammed and crushed. In observing the markets, one finds that quite half the packages are not full when they reach the salesman. The Peach is a dessert fruit and should command a fancy price. Therefore, it should be packed in dainty baskets, and the packages should be sold with the fruit. Peaches in bushel baskets is a contradiction of ideals: the bushel package is for apples, potatoes, and turnips.

In New Jersey and Michigan the staple Peach package has been the tall, wide-topped basket. Of late years, however, different forms of the Climax basket (Fig. 1674) have come to be popular, and in some parts of the country they are used exclusively. The fruit always should be packed after it is picked, the best grade being carefully placed in the packages by hand.

Insects.—The two most serious insect enemies of the Peach are the borer and curculio. The borer usually works in the crown of the tree near the surface of the ground. The borer itself is the larva of a wasp-like moth. It is an annual insect, completing its life-cycle within a twelvemonth. The eggs are laid in summer. By October, in most parts of the country, the larva is large enough to be detected. In September or October, therefore, it is well to grub the trees. The earth is removed from the crown with a hoe or strong iron trowel, and whenever a hole is discovered in the bark or gum is exuding, the bark is cut away with a knife until the grub is discovered. Not all the grubs can be detected at any one grubbing. It is well to go over the trees again the following May or June, to catch the large grubs before they pupate. The grubbing of trees may seem like a laborious operation, but it is not expensive if done frequently and thoroughly. It does not compare with pruning in cost or labor. It is the only sure and satisfactory way to avoid injury by borers.

The curculio attacks the fruit. Soon after the blossoms fall the small weevil or beetle, which resembles a pea-bug, lays its eggs in the fruit; and from these eggs a grub soon hatches, and the Peach becomes wormy. The eggs are laid during a considerable period—from two to four weeks—depending on the location and the season. The insect is more or less dormant in the cool of the morning and will drop when the tree is jarred, and this allows the peach-grower a chance of catching it. A large sheet, covering the spread of the top, is laid under the tree and the tree is jarred quickly two or three times, when the curculio falls, and it is then picked from the sheet. There are various apparatus for catching the curculio, all working on the above principle. One of the best of these is a 2-wheeled rig, something like a wheelbarrow, which carries a large canvas or muslin hopper. There is an opening in the hopper opposite the operator, to allow the hopper to be wheeled under the tree so that the trunk may stand near the middle of the machine. When the machine is in place, the operator gives the tree two or three quick thumps, and the insects drop. Usually, there is a tin or zinc receptacle at the apex of the hopper into which insects may be shaken. This bugging operation is begun early in the morning, usually by five o'clock. The first exploration with the bugging-machine is made within a week after the blossoms fall. If insects are found the operation is continued. If the insects are very abundant the bugging will need to be done every morning; but if they are not abundant it may be necessary to go over the plantation only two or three times a week. The bugging is continued as long as the insects are found in sufficient quantity to do much damage. Two or three weeks will usually cover the egg-laying season; but sometimes the catching must be continued even longer than this. This bugging is a laborious operation, but it is the only sure method of combating the curculio. The work can be made much more easy and expeditious if the ground is hard and firm, to allow the machines to be wheeled readily. It is well, therefore, to till the orchard as early as possible, and if the ground is very soft to go over it with a slicker or other compacting implement just before the bugging operation begins. After the curculio catching is done, one may begin the thinning of the fruit. All Peaches which give evidence of having been attacked by the curculio are then picked; this is an important means of keeping the pest in check.

Diseases.—The Peach is subject to many insidious and inexplicable diseases. Of these the worst is yellows. The yellows is a distinct disease. It is not a condition. It attacks Peach trees of all ages and in all conditions of vigor, seeming to have a preference for those that are thrifty. It is incurable, and its termination is always fatal. It is communicable from tree to tree. The means of communication is unknown, but it is not spread through the soil, it probably does not originate in the roots, it is evidently not conveyed from flower to flower, and it is probably not transferred by means of pruning tools. It may be disseminated by buds, even by those from branches that do not yet show signs of the disease. The one unmistakable symptom of yellows is the red-spotted character of the fruit. The flesh is commonly marked by red lines or splashes beneath the spots. These Peaches generally ripen prematurely, and in the second year they are usually smaller and often more fuzzy than the normal fruit. The second symptom to appear—or the first in trees not in fruit—is the "tip" growth (Fig. 1675). This is a short growth starting from the upper or terminal buds, usually late in the season, and is characterized by narrow stiff yellowish small leaves which stand at nearly right angles to the shoot. Sometimes these tips

appear late in autumn, after the leaves have fallen, or in spring before normal growth begins. They are often first seen upon the ends of watersprouts. This "tip" growth is sometimes little pronounced, and then only a practiced eye will detect it. The third mark of the disease is the pushing out of slender stiff-leaved yellowish shoots from the body of the tree or the sides of the large limbs (Fig. 1676). In pronounced cases, or when the tree is about to die, these shoots may branch into close bunchy tufts. These symptoms are frequently wholly absent in this state throughout the entire course of the disease.

1667. The Michigan vase-form tree.

In its final stage, the yellows is marked by small and slender growth of all new wood, small, narrow, yellow or reddish foliage, and occasionally by a great profusion of slender and branchy growths in the center of the tree. As a rule, yellows trees die in five or six years from the first visible attack, sometimes sooner. The yellow and stunted condition following neglect or the work of borers—both of the common borer and the pin-hole borer—is often mistaken for yellows. Extermination of all affected trees—root and branch—is the only method of keeping the disease at bay. This work should be done vigorously and thoroughly. The entire community should unite. Trees may be set in the places from which the diseased trees are removed, without fear of contamination. The cause of the disease is wholly unknown. Almost every ascribed cause has been disproved upon careful investigation. Even when the cause shall have been discovered, the remedy will probably remain the same—extermination. The disease has no uniform preference for varieties, soils, climate, nor methods of propagation or cultivation. No fertilization of the soil will cure the disease or check its spread. The disease sometimes attacks the almond, apricot, and Japanese plum. Yellows has been recognized for about a century. It is peculiar to North America, and is generally distributed north of the Carolinas and east of the Mississippi. For more specific information on Peach yellows, consult the writings of E. F. Smith, published by the U. S. Dept. of Agric.

Rosette is a very serious disease of Peach trees in the southern states, characterized by dense rosettes or bunches of foliage on the young shoots. It soon proves fatal. The cause is unknown. The remedy is to exterminate the trees as soon as the disease appears.

1668. Peach trees in Eastern Maryland.

The leaf curl has been the subject of more concern amongst Peach-growers during the past few years than any other disease, except the yellows. It has a decided preference for some varieties, particularly those with large, soft and dark-colored leaves. It is also influenced greatly by the season, although it is rarely wholly absent. A moderate attack does not perceptibly injure trees in full vigor. In many cases, however, the larger part of the leaves fall from the tree in June, and the fruit, deprived of nourishment, may also fall. Leaf curl, the curculio and lack of pollination are the chief causes of the "June drop" of Peaches. The leaves "curl," or become puckered, early in the season, and soon die. Experiments have demonstrated that a thorough spraying with full-strength Bordeaux mixture just before the buds swell in spring is very nearly a specific. If long-continued wet weather follows, it may be advisable to spray again, when the petals have fallen, with Bordeaux mixture, consisting of 2 pounds of copper sulfate, 2 pounds of quick-lime, and 50 gallons of water. If the weather of April and early May is warm and dry, this second spraying will be unnecessary. For full account of Peach curl, see Newton B. Pierce, Bull. 20, Div. Veg. Phys. and Path., U. S. Dept. Agric., 1900 (pp. 204).

"Little Peach" is a recent disease which has appeared in Michigan and western New York. It is ordinarily characterized by the Peaches remaining small and hard, the trees losing vigor and the leaves becoming small. After a time the tree dies. It seems to spread when once established in an orchard. The cause of the difficulty is quite unknown. By some it is thought to be due to a root fungus. Others have associated it with dry seasons, the lack of fertility in the soil, overbearing and other exhausting processes. It has every appearance, however, of being a distinct disease. No remedy is yet known. Growers are advised to pull out the trees and burn them as if they had yellows. Some growers think that they can overcome the disease partially or wholly by liberal applications of nitrogenous fertilizers and by extra attention to tillage. All these questions, however, yet remain to be demonstrated.

1669. View in a young Michigan Peach orchard.

Fruit-rot and twig-blight, due to the fungus *Monilia fructigena*, is a serious disease of Peaches. The rotting of the early Peaches on the tree is too familiar to need description, but it is not generally known that this decay is not a normal process and peculiar to the variety, but is caused by a distinct fungous disorder. Very often these same trees that show the fruit-rot have the young growth blighted, as if attacked by something like pear-blight. This death of the shoots is due to the same fungus that causes the fruit to rot. The decayed Peaches sometimes dry up and hang on the tree, and become a prolific source of infection for the coming year. These mummified Peaches can be found in orchards all over the country, even, in many cases, a year following the attack. They are likely to be most abundant in the center of the top, and the fungus often kills the twigs that bear the diseased fruits. The same fungus attacks the cherry and plum. Prof. F. D. Chester, of the Delaware Experiment Station, found that the fungus sometimes destroys the flowers in spring, and this injury may pass for the effects of frost. He also found that thorough spraying with copper fungicides greatly reduced the injury. His advice for the treatment of the disease is as follows: (1) Gather and burn all mummified fruit. (2) Early in the spring, before the fruit-buds

begin to swell, spray the trees with a solution containing 1 pound of copper sulfate to 25 gallons of water. (3) As soon as the fruit-buds begin to swell, spray the trees with Bordeaux mixture or copper carbonate. Follow this by another spraying before the buds open. (4) As soon as the fruit shall have reached full size, make a third application. This may be followed by two or three applications at intervals of five or seven days during the ripening period. It will probably not be often necessary to make more than one late application. Thorough thinning of the fruit is a good preventive of the spread of the rot.

There are no up-to-date American books on the Peach. Three works have been published: Fulton's "Peach Culture," 1870, new edition, 1889; Rutter's "The Culture and Diseases of the Peach," Harrisburg, Pa., 1880; Willcox's "Peach Culture," Bridgeton, N. J., 1886. There are several excellent experiment station bulletins on the Peach. See also, Fitz's "Southern Apple and Peach Culturist," and Black's "Cultivation of the Peach and the Pear on the Delaware and Chesapeake Peninsula."

L. H. B.

Peach Culture in the South (Fig. 1677).—Peaches have been abundant in the southern states since the very earliest settlement, the so-called Spanish varieties being first distributed by the early settlers in Florida, and to this day, all through the South Atlantic states the old "Spanish Blood," or "Tinsley" Peach, is spoken of as one of the choice fruits of the earth. From time to time all the improved varieties were scattered through the South by the more progressive horticulturists and nurserymen, and these and their seedlings were abundant on nearly every plantation. The South being strictly an agricultural country, there was little chance for commercial Peach culture until along between 1870 and 1875, when the introduction of a number of new extra-early varieties of the Alexander type, seedlings of Hale and Rivers, gave such bright, showy Peaches the latter part of May and early June that attempts were made to market them at a profit in our Northern cities.

A lack of quick, through railway-express service caused them to be three and four days on the way, and usually to be delivered in bad order. Occasional lots, arriving in fair to good condition and selling at from $12 to $20 per bushel convinced a few of the shippers that the extra-early Peaches of the South were appreciated at the North, and persistent efforts were continued to get them to market in sound condition. Every conceivable

1670. Unpruned thick-topped Peach tree.

style of shipping package was used,—paper-wrapped fruit placed between layers of cotton, excelsior, paper, etc., and sent by express or steamer,—and all brought about the same returns, "Arrived in bad order." Only occasional lots paid a profit. Finally, heavy refrigerator boxes that would hold about 6 bushels of fruit in packages, and a sufficient quantity of ice, with strong caster wheels under them so they could be trundled in and out of freight cars, were utilized to bring Peaches north by Savannah and Charleston steamers; and by re-icing on the steamers much of the early fruit came through in good order and sold at such satisfactory prices as to encourage the

1671. The interior weak branches are removed. (Compare Fig. 1670.)

sending of the large midsummer Peaches to market in the same way, and the planting of moderate sized orchards and the further experimenting with seedlings and varieties best suited to long shipments.

The perfection of the refrigerator car for fruit transportation, improved machinery for the cheap manufacture of ice, the consolidation of various small railway lines into great through routes of transportation, and a full appreciation by their managers of the importance of a successful Peach industry, and last but not least, the originating of the Elberta Peach by Mr. Rumph, were the final factors in rapidly developing the great commercial Peach industry in Georgia, and its smaller counterparts in S. C., Ala., Miss., Ark. and Texas.

The year 1889 saw the first large Peach crop successfully harvested and marketed. Profits were large, and being reported in the press many times greater than they really were, stimulated much planting by those entirely unfamiliar with fruit culture, and with no special love for it except the money that might be made out of it. Cheap lands and the abundance of good, low-priced labor were encouragements to extensive plantings. In nearly every state of the South, land in vast tracts suitable for Peach culture may be had at from $3 to $10 per acre, and labor from sun to sun at from 40 to 60 cents per day. Along the Atlantic and Gulf coast, varying from one to two hundred miles inland, most of the land being low and flat, early blooming, followed by spring frost, makes the Peach industry too uncertain to be profitable. The hill lands in western sections of Atlantic coast states, and northern sections of the Gulf states, is really the Peach country of the South. Fort Valley and Marshallville, the great Peach centers of Georgia, though on tablelands about two hundred miles from both ocean and Gulf, and at an elevation of a little over 500 feet, are not in what might strictly be called the hill country, being just below the southern edge of it. In this section of Georgia, most of the Peach orchards have been planted on old cotton-land, much of which has been in cultivation a century or more, and while the surface-soil is worn and poor, down deep in the red clay soil underlying the 6 or 8 inches of sandy, gray loam of the surface, there must be a vast amount of fertility from the way Peach trees grow when once started and a reasonable amount of culture is given.

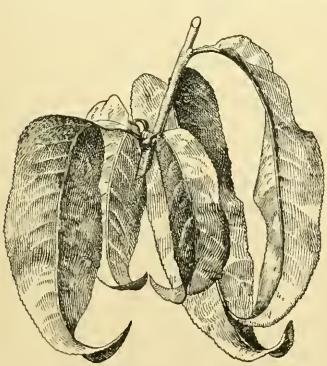
A majority of the orchardists, who are cotton-planters as well, plant second- and third-class yearling trees, or

else small June-budded trees any time from October to March; opening furrows for the trees and cross-checking the rows 18 to 22 feet apart; later plowing this land and planting it in cotton, continuing it for three and often four years. Two to four hundred pounds of low-grade fertilizer is applied in drills for the cotton and usually very thorough culture given; trees are allowed to grow at will, their culture being incidental to the cotton crop. In such orchards very little if any pruning is ever attempted. After the trees become so large as to drive out the cotton, one plowing is given in winter, then anything from fairly good culture to none at all the rest of each season. Such a system results in many "scrub orchards," that are not very profitable after six or seven years.

Specialists, who devote almost their entire time to the Peach business, plant their trees mostly 16 x 16 or 18 x 18 feet and give them entire use of the land. The undersigned, being a rather close pruner, has about 150,000 trees planted 13 x 13 feet and about 175,000 planted 15 x 15 feet.

All land is plowed deep, and sometimes subsoiled before planting. Young orchards are given frequent and thorough tillage up to mid-season, when 2 or 3 rows of cow-peas are drilled in at least 4 feet away from the rows of trees; these and the trees are cultivated frequently, until the peas have taken almost full possession of the ground, and it is time for both the land and trees to have a rest from cultivation. In the fall when peas are ripe, enough are gathered for next year's seed, after which hogs or mules may be turned in to pasture for a time. The stubble furnishes a fine winter cover, and is turned down at first plowing in February or March, when summer culture begins, and at proper time the orchard is again seeded to cow-peas, across the former direction of the rows. Three years of this usually builds up a perfect orchard without the aid of any other fertilizers, except possibly a very little about the trees at time of planting to give them a start.

Low-headed trees are the rule, the trunks seldom branching over 18 inches up, and often 8 inches to a foot from the ground. In one section of the writer's orchard at Fort Valley, Georgia, he has 100,000 trees 8 years old, headed so low that in a full-crop season like 1900, a man sitting on the ground could have gathered fully one-half the fruit from each tree.



1672. The three leaves at a joint, where some of the fruit-buds are forming.

As a rule, the close cutting-back at time of planting, and a general shortening-in of the leading branches for the first 2 or 3 years, is about all the pruning given, even in the best orchards. Our own plan is to shorten in every year much of the past season's growth, and from the central head often cut back 2 or 3 seasons' growth; but under no circumstances are any of the good side shoots cut out that force themselves on all the main stems when the top is properly headed back. Figs. 1678, 1679. These little side branches have given the writer several full crops of fruit, when without them there has been failure.

Soil and climate favor the very brightest of color on all Peaches in the South; qualities of the soil and the long, hot summer sun give a richness and sweetness of flavor superior to any other section of America, though the same varieties are not as juicy or luscious as when grown further North. The writer's observation leads him to believe that there is more water and less of solid matter in the Peach the further one goes North with its production, and while one can eat more of the northern Peaches ripe from the tree it takes the southern-grown Peach to put fat on one's ribs. During the past ten years, besides very heavy plantings by southern landowners, northern fruit men singly and in corporations have planted extensively of Peaches all through the South, most largely in Georgia to the south and west of Macon, within a radius of 50 miles.

1673. Fruit-buds of the Peach with leaf-bud between.

The orchards in connection with cotton plantations run all the way from 10 to 100 acres in extent, while the "straight-out Peach farm" seldom has as few as 50 acres in fruit, more of them having from 100 to 200 acres, while orchards all the way from 300 to nearly 3,000 acres in extent are no uncommon sight. Samuel H. Rumph, at Marshallville, Georgia, has more than 1,000 acres superbly cultivated in orchard; the writer's orchard at Fort Valley, Georgia, has considerably more than 2,000 acres in fruit trees, 335,000 of which can be seen from an outlook on the central packing house. Rows of trees 1½–2 miles in length stretching away in all directions give a powerful impression of the Georgia Peach industry, which turns out 2,500 to 3,000 car-loads of Peaches in the 6 or 7 weeks of a busy picking season, and yet has not one-half its planted trees in really full fruitage.

Growth usually ceases early in August, and the trees shed their leaves the last of September, a month or 6 weeks before any frosts come. Should the fall be warm and wet, some fruit-buds will be forced into bloom, while the great majority will remain dormant until late January or early February, when spring growth commences. The season of full bloom is usually about the first week in March, though it varies all the way from February 15 to March 25, and no matter whether early or late, the entire blooming season of most varieties covers a period of nearly 3 weeks. While spring frosts are the greatest menace to southern Peach culture, this long blooming period often gives a chance for a setting of fruit between the various frosts, or after the last one, from some belated buds. Even with these varying chances of escaping between frosts, about one year in three Jack Frost is master of the situation, and there is no Peach crop. Two other serious troubles hamper the southern Peach cultivator — curculio and monilia or brown rot. Curculios are very abundant; beginning early in April, they keep up their destructive work until the end of the fruiting season. When the crop is abundant frequent thinning of the stung specimens and burning them prevents serious harm, although the extra expense is considerable; but in seasons of short or moderate crops trees must be jarred daily and the curculio gathered on sheets or canvas trays and destroyed. During the season of 1896, in the Hale orchard, 100,000 trees were freed from the curculio by jarring 50,000 trees every other day for 7 weeks. A practically perfect crop of fruit was harvested, and the orchard shipped more sound fruit than any other 500,000 trees in the state, or nearly one-quarter of Georgia's Peach crop of that year.

The early spring months at the South are inclined to be pleasant and very dry, and the summer rains, which are frequent and abundant when they do come, often do-

not set in until the latter part of July or early August, near the end of the Peach shipping season. Often, however, they begin in June, and continue for 2 or 3 weeks, and in the case of the season of 1900 it rained for 6 weeks right through the main part of the Peach harvest. Hot sun between showers and the general mugginess of a warm climate rapidly breed the monilia fungus, and brown rot is prevalent on every fruiting tree. Spraying with straight Bordeaux mixture just before the buds swell in the spring, and once or twice more when the fruit is developing with Bordeaux hav-

1674. Peach packing. The Climax basket (Michigan).

ing an excess of lime, is practiced by a few, and holds the rot in check to a considerable extent. Besides the sprays in the Hale orchard, if rot appears, we go over the fruiting trees every day or two, and gather and burn all fruit showing even the smallest speck of rot, and in this way secure much more sound fruit than when only the spraying is practiced. In a majority of orchards, however, neither spraying nor picking the rot is practiced, and the loss of fruit is often from 50 to 80 per cent of the entire crop.

The first great crop of Georgia Peaches that made a strong impress on all northern markets was in 1889, when the Elberta variety by its large size, great beauty and fine keeping qualities showed up so strongly for the first time as to outclass all other varieties. Great profits were made and, being reported as even greater, there was a mad rush to plant Elberta, and Elberta only. This was kept up until 1896–7 before it came to be realized that there could be too much of even a good thing. The rushing of a great volume of fruit, no matter how choice, into the markets in 2 or 3 weeks, before they had been "toned up" to at least a liberal supply of good fruit, was a business mistake. To remedy this there has been for the past four years a hunt after a good early variety to precede the Elberta, as well as later ones to follow it. So that while prior to 1896 more than 75 per cent of the plantings were of Elberta, since that time not more than 15 to 20 per cent of Elberta have been planted. There is a better balance of varieties, and a longer and more profitable season of marketing has been assured. A few Alexanders are yet planted and open the season late in May. Triumph, ripening a few days later, has been largely planted; it suffered most from rot in 1900, and while of good size and very fine quality, from its "woolly" appearance and early decay, it thoroughly demoralized the early markets; and when the thousands upon thousands of Triumph trees not yet in fruiting come into bearing a demoralization of early southern Peaches is sure to result, that will take several weeks of each Peach season for the markets to recover from, after better varieties begin to come along. Early Rivers, coming to much higher color in the South than in central and northern states, has always been very profitable.

The little Tillotson, that mildews its foliage in the North so as to be a general failure, comes to a perfection of tree and fruitage in the South; the bright red little Peaches, seldom more than an inch and a half in diameter, rich, sweet and delicious, are really the first extra good Peaches to find their way to market. Greensboro a little earlier, and Hieley and Waddell a few days later, are all very large and beautiful early Peaches, that are being extensively planted. Carman, of extra size and great beauty, follows a little later; while St. John, Mountain Rose, Thurber, Belle of Georgia, Elberta and Stump, make up most of the rest of heavy planting; while Emma and Frances are being most largely planted to close up the season from the 1st to the 10th of August. Some Peaches of the Crawford type are grown all through the South, but they do not succeed as well as most others of the Persian strain, and none of the Persians do as well in the far South as the North China strains, to which Waddell, Thurber, Belle and Elberta belong. The South China Peaches, to which the Peen-to, Honey and Angel belong, succeed best in Florida and close along the Gulf coast. While their bitter-sweet flavor is appreciated by some, they are not generally profitable for market.

In preparation for marketing the fruit crop, many of the large orchards have railroad side-tracks running to their packing houses in the orchard; refrigerator cars are brought South, and every available bit of side-track for three or four hundred miles about is filled with these cars. At leading centers, refrigerator car people have constructed great ice storage houses, with every convenience for quickly icing and re-icing cars. Agents of these refrigerator car companies, by frequently driving about among the orchards and keeping in touch with the managers, plan to have enough cars iced up and cooled off so as to be ready for each day's demand, and by placing an order with the railroad agent the night before, the orchardist may have one or a dozen refrigerator cars delivered on his side-track in the morning. For smaller shippers, who cannot load in car lots, the railroads keep at all times in season refrigerator cars on siding at each station in the Peach district, into which any number of shippers may load; more often there will be a number of such cars loading at the same time, so that a shipper may have a choice as to which market he will consign his fruit. Except in the height of the season, these cars are often two and sometimes three days in loading, and the continued opening of the car to put in small lots of fruit prevents perfect refrigeration; consequently fruit from small shippers more often goes to market in bad order than from the larger orchards, where a car can be quickly loaded and at once closed up, not to be opened until ready for sale in some northern market. In the Hale orchards a car is often loaded in an hour, and very little of the fruit is ever so long as two hours passing from the tree through the assorting and packing houses to the car. For ten successive mornings, season of 1900, there were picked, graded and nailed up in crates, and the doors closed and sealed up, three car-loads before eight o'clock in the morning; seven o'clock and fifty-four minutes was the latest, and seven thirty-five the earliest finish. Only by a lively start at daylight can such work be accomplished.

In some of the smaller orchards, fruit is packed in crates or baskets right under the trees, and then hauled in open wagons, often without springs, to the railroad station. In others, some of the old farm buildings are used as packing houses; more often special fruit houses are used, their size depending upon the requirements of the orchards, while in style and convenience more depends upon the intelligence of the orchardists and desire to handle the fruit rapidly in best possible manner. The picking basket most generally used is a shallow, round basket, with a drop handle, and holding about a half-bushel. With good refrigerator cars and prompt railroad service, fruit is now allowed to come to full maturity on the tree, and is picked just before it begins to soften.

In the Hale orchard expert pickers instruct all new workers how to judge by the color on the shady side of a Peach, when it is ripe for the harvest; then each picking gang is in charge of a foreman, who is ever on the alert to secure uniformity in the work. Each picker is numbered, and has a little canvas bag with his number stenciled on it, and filled with

tickets of same number; one of these tickets is placed in the bottom of each basket as he begins to fill it, so that when any basket reaches the assorting table and proves not to be up to the standard, the inspector of grading is notified, the ticket number given to a field inspector, who on horseback gallops away to tone up the careless picker. Picking 3,000 bushels or more of Peaches in a day, it is possible at any time to locate the picker of every basket. This great orchard is all blocked off by avenues running north and south every 500 feet into about 12-acre tracts, with cross streets every 1,000 feet, so that 250 feet is the greatest distance from any tree to an avenue of travel. Each picking gang has its required number of "basket boys" and "toters," who keep the gang supplied with empty baskets, and "tote" the full baskets to the avenues, where they are loaded on broad, low-down wagons, holding about 80 baskets, and hauled to the packing house, which is a two-story building 40 x 112 feet. The second story is used for storage of crates and baskets, all labeled and finished for immediate use, while the first floor is a platform 3 feet high, sides open all around but protected from sun and rain by a lean-to shed about it, under which the wagons drive as they come from the fields with the fruit.

Two wide packing benches run the entire length of the shed; through the center of these benches, raised nearly a foot, runs a line of canvas trays or pockets, about 18 inches wide, and divided into sections about every 2 feet. Along the outside of these benches, with room enough back of them to receive the fruit from the wagons, stand the graders—bright young men and women from the best white families of the South. There is room enough on the sides of the bench, in front of the canvas trays, for a row of picking baskets, filled with the fruit just as it came from the tree. With one or two expert graders along this line to instruct in the work and consequently keep it toned up, the sound fruit is assorted direct from the picking baskets into three sizes: extras, No. 1's and seconds, all carefully placed in the canvas trays in front. Overripe and bruised fruit goes in baskets at the feet of the grader and finally reaches the evaporator, while the decayed or otherwise worthless fruit goes to the dump and is destroyed by fire. On the opposite side of the bench, facing the graders, stand the packers, with just room enough on the edge of the bench in front of the trays for the 6 basket carriers to stand lengthways (this carrier from long experience having been found to be the one best and most profitable package to handle the southern Peaches). Removing the top layers of baskets and division trays, the bottom tier of baskets is quickly and firmly packed solid full of whatever standard size fruit happens to be in the trays in front of each packer. The division rack and top tier of baskets are then replaced, and filled in the same uniform way. Instructors and inspectors of packing are constantly working up and down the line, encouraging and assisting in the work, so that uniform results may be secured.

As each package is finished a card with the packer's number is placed on top, and call of "Crate!" promptly brings a "toter," who hurries it to an inspection table, one of which is at each end of the shed. Here an inspector, who is trained to know good Peaches and good packing at sight, either approves it and orders on the cover, or if poorly packed, not full enough, or in any way defective, sends it back to the packer to be righted. Some packers will not put up more than 40 or 50 crates per day, while very expert ones put up as many as 150 and in some cases 200; while the average is from 75 to 80 crates per day when the work is done under the most careful inspection. The name of the variety and grade of fruit is stenciled on the cover, as it is nailed on, and the packer's number is penciled on the red label, on each end of the crate; then away to the car. Here, placed side by side about 2½ inches apart across the car, it takes 7 crates. Then two strips of inch-square stuff, just long enough to reach across the car, are put on top of the crates at each end and are lightly nailed down. Tier upon tier is built up in this way, either 5 or 6 crates high, until the car is full. Spacing of the crates and the slatting provides space for cold air around each and every crate. In dry seasons, when fruit is free from rot germs, cars as now constructed can with safety be loaded 6 crates high, but in wet seasons, with rot prevalent, they arrive in market in much better order when loaded only 5 high. Besides the original icing, which requires 4–6 tons to a car, a re-icing after loading takes 1–3 tons, depending upon how long the car is loading. In going to New York, cars are re-iced at Atlanta, Charlotte, N. C., and Alexandria, Va., and if to New England points again at Jersey City. For Chicago and the Northwest, they are re-iced at Atlanta, Cincinnati or Louisville. A car will hold 525–650 crates, according to the size of the car and whether loaded 5 or 6 crates high. Handled along best modern lines, with careful inspection from start to finish, it costs, including freight and all incidental expenses, from 26 to 28 cents to take Peaches ripe from the tree and place them in the car. Freight averages about 42 cents to the various northern markets, refrigeration 13 cents, cartage 3 cents, and commission 7–10 per cent of gross sales, bringing the actual cost up to about $1 to pick and market a crate of Georgia Peaches, holding six 4-quart baskets. The bulk of the fruit sells at $1 to $1.50, a little sells as high as $2.50 and $3, while considerable is sold at less than a dollar, down to as low as 25 cents; this, of course, for fruit arriving in bad order.

1675.
"Tip growth" of yellows.

Left-hand specimen shows two small-leaved tips appearing in October, 2 or 3 of the normal leaves still remaining near the top. The middle specimen shows numerous tips appearing in August. Right-hand specimen is a healthy twig, for comparison. P. 1231.

Sales at anything above $1 per crate can be counted in towards cost of production and as profit. J. H. Hale.

Peach Culture in the Far North.—Having tasted Peaches that were thoroughly ripened on the tree, the writer became very desirous of growing this fruit at his home in northern Vermont, and knowing that the fruit buds of the Peach tree are not of sufficient hardiness to endure the rigor of this climate without protection, he exercised himself for some cheap and effective way to cover them. He remembered that when a boy his father had some Peach trees near the house that had been allowed to branch at about a foot from the ground. One

winter, in a severe snow storm, a branch of one of them was weighted down by the snow and partly split from the trunk and lay there until spring. Though the thermometer during the storm fell to 30° below zero, that branch bore fruit the next season. Remembering this, the undersigned felt confident that if he could train Peach trees so that the tops could be easily brought down to the ground and covered, he could grow

1676. The tufted shoots of Peach yellows. (See p. 1231.)

this most delicious fruit. After experimenting some time the following method was found to be efficient.

Secure a very young tree, preferably a seedling from seed, planted where a tree is desired, and train the trunk of it horizontally 8–10 inches from the ground, and suffer no branches to grow. Break off the tender branches when they are not more than 3 inches long by bending them sideways, not down over the leaf, as that would be likely to break off the leaf also. The trunk is kept horizontal while it is growing by tying it loosely to a slender pole, which is fastened horizontally. Of course the tendency of the tree is to grow upward at the end, and therefore one must look to it about once a week that the branches are broken off and the trunk tied down. When trained in this way the tree will continue to grow vigorously until frost stops it, but it is necessary that the young wood has time to ripen sufficiently to endure the winter. The writer finds that if he ceases to break off the branches for 4–6 weeks before the usual time of frost, the wood at the end of the trunk will be sufficiently ripened to stand the winter when protected.

To protect the tree the first winter, take some half-inch boards about 3 inches wide, and nail their edges together so they will be like a wooden eave-trough. Then cut the tree trunk loose from the pole to which it is tied, put 2 or 3 shovelfuls of earth around the roots and place some evergreens on the ground under the trunk (just enough to keep it from the soil); lay the tree upon the evergreens and place the trough over the tree, covering it completely from root to tip. Finally place a few evergreen boughs over the whole. If the butts of the boughs are thrust a little into the ground they will be frozen in and held firmly.

In the spring when danger from frost is past uncover the tree, fasten the little pole in its place, tie the tree to it and place the trough over the whole of the tree, except a little of the tip. This is important, for if this horizontal trunk, which now has no leaves, is not covered from the sun the bark will surely be killed along its top. After the buds at the tip have grown a little, break off all but the strongest, and train as in the previous year and so continue until the desired length of trunk is obtained. If the tree is in good soil and well cultivated it will in 2 or 3 years make a trunk 10–15 feet long. When this latter length is attained the trunk is long enough to be pliable for a good many years, as its thickness does not increase very fast. Now, while keeping the horizontal trunk in its place, allow its end to grow up and form a head, which may be trained in a fan-shaped fashion, parallel with the trunk. A stout stake is driven at the place where the head is formed, to which it is tied during the growing season. When freezing weather comes the head is loosened from the stake and turned over sideways on some evergreens placed to keep it off the soil. Over the head of the tree put a few more evergreens and over these some boards to keep snow from sifting in, which will melt during a mild time, and later form ice about the twigs and kill them.

From this time the treatment of the tree is the same as that of any fruit tree, except that it must be covered each fall and tied up each spring. The writer was warned that he would be troubled with mice under the coverings, but he has practiced plowing between the trees each fall, turning the furrows toward the trees, and has not been troubled with the rodents. Trees treated in this way never fail to bear and produce as abundantly as when grown upright from the start.

J. T. Macomber.

The Michigan Peach Industry.—The history of commercial Peach-growing in Michigan would be a fascinating tale indeed if it could be written in detail. The eras of prosperity bringing on in many cases the wildest speculation in property, followed sometimes by severe depressions, have given our prominent Peach centers some of the features of a western mining camp. Frequently some shrewd painstaking grower rises to affluence with a few crops from a well-grown orchard, on a wisely selected location, and there immediately follows a class of men who take money out of other lines and plunge into the mysteries of Peach-growing with the recklessness of a gambler, often purchasing most unsuitable locations, planting large quantities of ill-chosen varieties, cultivating them for a few years, only to learn in the end that Peach-growing is a profession, and the production of large quantities of luscious, beautiful fruit, and getting them to market at their highest stage of excellence, is no mean art.

The so-called Peach belt of Michigan is a strip of country located on the east shore of Lake Michigan, varying in width from five to ten miles. In three or four locations, owing to the favorable contour of the lake and topography of the land, Peaches are grown with a marked degree of success, even as far as forty miles inland. This belt begins probably fifteen miles south of St. Joseph, in Berrien county, and extends northward to the northern shores of Traverse bay, Leelanaw county, a distance of some 190 miles; but not all of this belt is successful even though near the lake, it being a notable fact that the most successful regions are where the land line extends nearest the center of the lake, while it is noticeable that where the lake is broadest, extending into the land, the least success is attained.

The wonderful success of this region can be accounted for by just two conditions, a suitable soil and the thermal influence of Lake Michigan. The combination is so good that this region has not seen an entire failure of the crop in thirty years, and very few light crops. Usually there are three to five heavy crops to

A Michigan Peach orchard in bloom

one light one where orchards are properly located and correctly handled.

The history of the industry can probably be dated to some year prior to 1860, but it did not reach any prominence until about 1864 and was at high tide by 1867. At this time and up to this date the commercial orchards were in a small radius around St. Joseph and Benton Harbor, the sales being almost entirely made in Chicago, as there were no railroad communications with other cities and the steamboat service to Chicago was fairly good. During the year 1867 yellows was first noticed by men who knew the disease, although it no doubt existed here a year or two previous. However, little attention was paid to this disease until it gained such impetus and virulence that these orchards, valued at and selling as high as $1,000 per acre, were swept out of existence. So thoroughly did this disease do its work that there were probably not as many as ten live Peach trees in a whole township in 1880. The pioneers of the Peach industry gave up in despair and either left the country or turned their attention to farm crops or small fruits, which latter industry soon gave this port, Benton Harbor, the distinction of being the heaviest shipping point for small fruit in the United States.

While this destruction of the orchards was going on at this point a few men at South Haven, 30 miles north on the high banks of Lake Michigan, with perfect soil and slopes and most beautiful surroundings, had begun the planting of orchards, and with wisdom born of misfortunes and with a higher intelligence, began to investigate the dread disease; and so well and correctly did they learn its treatment that to this day the yellows has never gotten the start of them and the orchards were never better nor larger than they are today, while the yellows had been constantly with them since 1875. In sharp contrast to this case, another point within 30 miles began setting Peaches about 1880, nearly the entire country being covered with beautiful orchards for miles around, but when the yellows appeared many owners, with strange perversity, refused to destroy diseased trees or allow it to be done under the law then recently enacted for the purpose of protecting orchards from destruction by this or other contagious disease. They even went into the courts to save dying trees from the ax and fire of the legal commissioners. The inevitable result was that in a few years this beautiful prosperous region was practically out of the Peach business.

During these years it had been discovered that Peaches could be grown with success and profit at points far north, and in some cases far inland, where the elevation was great, until now immense quantities are marketed in Kent, Oceana, Mason, Benzie, Grand Traverse and Leelanaw counties, while Berrien is rapidly regaining her lost prestige as the heavy producing county, an honor long held by Allegan county.

In all these counties the yellows now exists in nearly all orchards over four years old, but only in the hands of a careless few is it allowed to gain enough headway to menace an orchard. All men now know that as soon as the disease appears the tree affected should be destroyed by fire as commanded by law, and if neglected the entire orchard must pay the penalty. Commissioners clothed with power to act stand guard over the careless ones in every township, compelling them to destroy immediately all affected trees or do it themselves, charging up all cost and collecting it with other taxes. So well does this law work and so few are our other difficulties that this Peach belt is now beyond doubt the best in America, the crops being more profitable than those of California and more reliable than those of any other section.

It is impossible at this date to give statistics as to the acreage of yield, as the business is extending so very rapidly and the census report of 1900 is not yet issued. In a general way it may be said that this entire region is one of small orchards. Nothing like the mammoth orchards of Georgia can be found in the state, but orchards can be found in every neighborhood producing more Peaches from one acre than these mammoth orchards do from four, and giving regular annual crops. Trees well cared for usually begin producing at two years old, and at four years old should and do produce 4 to 5 bushels per tree, while the best orchards sometimes produce as high as 8 or 10 bushels on trees 6 to 8 years old and with trees set 20 by 20 ft., which is common practice, the yield varies from 200 to 800 bushels per acre.

The cultivation and care of the Peach orchard have undergone great change in the past 10 years. What might be styled modern methods prevail now in nearly every neighborhood; fine and thorough tillage, careful timely pruning and rigid thinning previous to the pit-hardening period are the rule among our best growers. They know that a tree overloaded cannot produce choice fruit nor can a tree weakened by an excessive crop of fruit produce a good crop the following year.

The best fertilization for our soils for Peach-growing seems to be phosphoric acid in the form of bone, and potash in the form of carbonate or muriate, with vegetable mold furnished every year by a growth of oats or other winter cover-crop sown after tillage ceases in August. This cover-crop holds all the Peach foliage where it falls. In the spring it furnishes a decomposed mass ready to be turned under to a shallow depth by gang plows.

The packages used are of various kinds, but the principal ones are the one-fifth bushel or 10-pound basket, the ½-bushel or 25-pound basket and the bushel basket for medium grades, while the 6-basket carrier crate, holding 30 pounds of fruit, is a favorite package for strictly fancy grades.

The markets, as well as the market facilities, are unsurpassed. With only 3-6 hours' run the lake steamers land the freshly picked fruit in Chicago or Milwaukee, where sales are made during the earlier morning hours, and shipment made by refrigerator trains and express for all the cities of the great west and northwest region where Peaches cannot grow. In this manner is the supply for the smaller cities distributed, while the larger cities are supplied by refrigerator cars loaded where the fruit is grown and sold to spot buyers or consigned to the commission trade. In addition to this five or six great railway systems take solid trains of refrigerators out of this region every evening on rapid schedules for points east and south, the favorite markets being Buffalo, Pittsburg, New York and Boston in the east, Indianapolis and Cincinnati in the south, while there has sprung up during the past two years a very large direct car-load trade with cities in Iowa and Missouri river points.

The profits of this crop vary so much according to the skill and judgment of the grower that it is well-nigh impossible to give accurate information, but it is probably a safe estimate to put the average net profit at $100 to $150 per acre for a term of years with ordinary care, but the best growers realize far greater returns. Indeed, in 1899, when all other regions except California had an entire failure, the region about Benton Harbor and St. Joseph had a fair crop and net returns of $300 to $500 per acre were common, while in one orchard over $35,000 was taken from 40 acres, and one block of four acres of Elbertas gave a return of $6,700, or $1,675 per acre, following with a crop in 1900 that gave a net return of more than $600 per acre in a year of great plenty and low prices. Such yields and prices are phenomenal, and should only be considered as indicating the possibilities of the crop under most favorable circumstances and with skilful management.

Several attempts at organization for commercial purposes have been attempted, but so far none have been entirely successful unless what is known as the central packing-house system now being worked at two points in the Peach belt may be said to be a success. This plan is one by which several growers combine and build a packing house on the railroad, hauling all their fruit to this central point, where it is all packed under the supervision of a superintendent and loaded directly into the cars, selling in car lots by grade either to spot buyers or in distant markets by wire so far as possible, consigning the balance to promising markets. This plan has the advantage of relieving the grower of the burden of operating a packing house, thereby reducing cost of packages and packing to a minimum and facilitating sales. The disadvantage is in hauling loose Peaches several miles, and in the extra handling, which causes bruising and injury to quality if fruit is ripe. This last fact necessitates picking the fruit rather green and

makes it unsatisfactory to the best trade, so that it becomes an open question as to the desirability of the plan. It is noticeable, however, that the largest and best growers almost invariably pack and ship their own product, believing that there is greater profit in a high individual reputation than in combination.

In another manner has the State Horticultural Society and an excellent system of State Farmers Institutes worked a vast benefit to the industry. They have held meetings singly and in series in every Peach-growing locality in the state. At these meetings every detail of modern high-class Peach culture and marketing has been freely given by the most successful growers of this and other states. These meetings have been followed by complete printed reports placed in the hands of every grower. In this connection it should not be considered too extreme to state that the help received by our growers from a few able practical and scientific men cannot be estimated in dollars. Suffice it to say that nearly every practicable idea given by these men has been quite generally acted upon with great financial advantage, and the improvement in handling this crop has been so marked during the past five years as to be really phenomenal. Nature having done its full duty to this region, the elements required for success are a careful selection of location with regard to soil, elevation and shipping facilities, a willingness to learn, and a love for the business, coupled with a high sense of honor in marketing. The adverse conditions are improper selections of location or varieties and the diseases, yellows and curl leaf, both of which are quite easily managed by energetic men. Trees affected with yellows are promptly removed and destroyed, and replaced immediately by young trees. The curl leaf is not regular in its appearance, but occasionally a season comes when its attacks on certain varieties are serious. It is easily controlled by preventive spraying.

The writer has visited many of the noted Peach regions, but nowhere has he ever seen such success attained by men of modest means as in the Michigan Peach belt. Its future looks even brighter than its past.

R. Morrill.

Peach Culture in Delaware. — 1. *Historical Sketch.* — No one knows when the first Peach trees were planted in Delaware, but undoubtedly there were many before the Revolutionary period. The trees were seedlings, and every old garden contained a sufficient number to supply the family with preserved and dried Peaches during the winter months. There was also a surplus, which the "lord of the manor" had distilled into Peach brandy, in which all gentlemen of the old school delighted. We read that as early as 1814, a Mr. Bayley, of Accomack county, Va. (a county south of Delaware on the peninsula), had 63,000 Peach trees, the product of which was converted into brandy. The trees at 6 years of age yielded about 15 gallons of fourth-class brandy per 100 trees, which sold at $2 per gallon. The profits could not have been large, unless the trees were planted much closer than they are now planted. It is possible that the seed was sown in rows, and the seedlings allowed to remain as they grew.

The first Peach orchard for commercial purposes in Delaware was planted in the spring of 1832, by Isaac Reeves and Jacob Ridgeway on a farm belonging to the latter, about one mile from Delaware City, on the Delaware and Chesapeake canal. It consisted of 20 acres of budded trees, and by 1836 they had planted 110 acres. In a single season Messrs. Reeves and Ridgeway received $16,000 gross from their Peach crop, the fruit then bringing from $1.25 to $3 per 3-peck basket in the Philadelphia market. This success induced others to embark in the business, among whom was Major Philip Reybold, who in 1842 had 12,960 trees. James Thompson was another pioneer in the business. In 1846 he stated that New Castle county contained about 3,000 acres in Peach trees. Major Reybold and his sons alone had 117,720 trees covering 1,090 acres, from which 63,344 baskets were shipped in August of 1845. In 1848, the Peach crop was estimated at 500,000 baskets, chiefly from New Castle county, of which the Reybolds grew about one-fourth. In Kent county, Jehu Reed had planted an orchard of Red Cheek Melocoton as early, perhaps, as 1829, and several years later had 10,000 trees. J. G. Brown in the seventies had one of the most extensive orchards in Kent county. In Sussex county, Capt. Chas. Wright was one of the first to plant trees on an extended scale, and in the sixties sold the product of a 10-acre orchard for $5,000 net. The varieties were Troth, Early York, Golden Rareripe, Oldmixon Free, Stump, Crawford Late, Mammoth Melocoton, Crockett White and Smock. Ex-Governor Ross and J. P. Collins were also extensively engaged in the Peach business, but the orchards in Sussex at that time generally consisted of from 1,000 to 5,000 trees each.

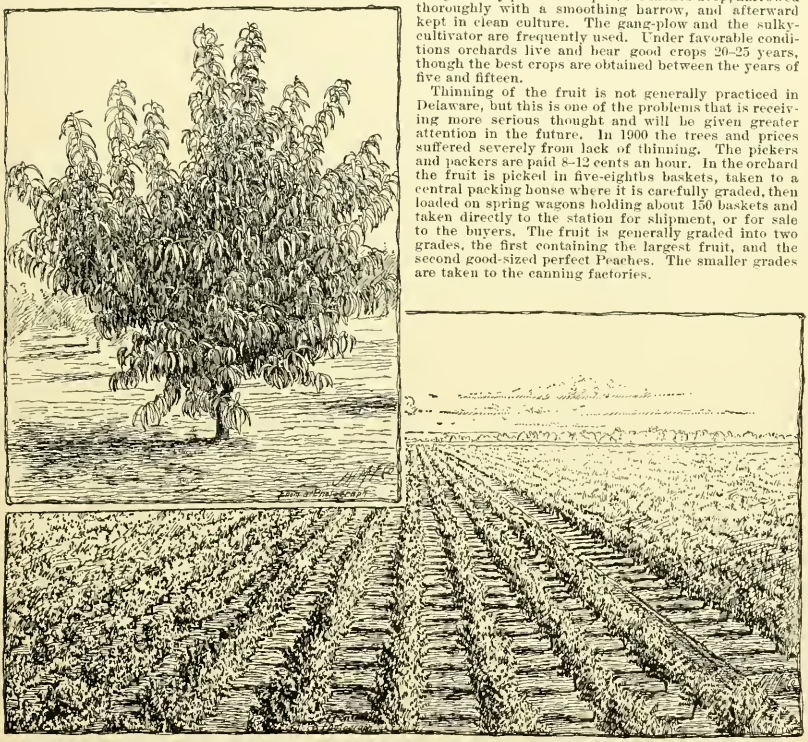
Governor B. T. Biggs, Governor John P. Cochran and J. B. Fennimore were among the largest growers around Middletown in 1871, and Scerick Shallcross, also of Middletown, marketed 125,000 baskets, valued at $150,000. This orchard contained more than 100,000 trees, and was said at that time to be the largest in the world.

Delaware was the first state to develop Peach culture on a large scale, and for years produced more fine Peaches than any other locality in the world. The quality, appearance and size of the fruit when grown under favorable conditions have never been excelled, if equaled, by any other section of the United States, but the appearance of the yellows in New Castle and Kent counties, the frequent destruction of the crop by untimely frosts, and the opening of other sections has taken some of the glory away from the once famous Peach districts of Kent and New Castle counties. The center of the industry was Middletown in the late sixties. Then it moved to Smyrna. After a few years Wyoming was the great Mecca towards which all the commission men looked for their supply; now it is Bridgeville. The Peach belt has been moving southward for several years, until now Sussex county raises the largest part of the crop. The trees do not attain the mammoth size of those on the heavier soils of New Castle and Kent counties, but Sussex, except in northern parts, has escaped that bugbear of Peach-growers, the "yellows."

There are probably about four million Peach trees in Delaware, though no accurate statistics have been made since 1890. The Delaware railroad company estimated that there would be 4,500,000 baskets of fruit along its various lines in 1900, but its records for the crop are not yet completed. On August 25, 35 car-loads, mostly of yellow fruit, were shipped from Bridgeville alone. There would have been at least 60 cars had there been a demand for white fruit, but a large proportion of the white Peaches were not picked in 1900. The Peaches are shipped to all of the large cities where freight rates are not prohibitive, and to smaller interior cities of Pennsylvania, New York and New England.

2. *Culture.* — Most of the trees are set in the fall. Where fall planting is practiced the tree pushes out young roots all winter during mild weather, and as a rule grows better than when set in the spring and is compelled to grow roots and leaves at the same time. The ground, preferably a clover sod, high and dry, is plowed deep, thoroughly harrowed and checked into rows generally 20 x 20 feet apart. Some planters set 22 feet, others closer. A hole is dug of sufficient size to admit the roots without crowding, and in November the tree is planted about the depth it formerly stood in the nursery, with soil heaped a little to allow for settling. For planting, the writer prefers a good one-year tree of the second or third grade, 2–3 feet in length, without many branches. The small nursery stock will make good trees if properly cared for and will last as long, bear as much fruit and come into bearing as young as trees 4–6 feet high. It is a great mistake to suppose the larger tree is better. It is more sightly, but that is its chief merit. It will not develop as many roots, nor will it pack in as good shape for shipping, and the shock of transplanting is far less to the small tree; it can be cut back root and top; it is much easier to plant; and the percentage of loss is much smaller, for if in good condition and well planted, 99 per cent will grow. The undersigned says this after having grown several million trees in the nursery and many thousand in the orchard of his own propagation and from other nurseries all over this country. On light lands a shovelful of wood ashes or of well-rotted manure gives the tree a good start. Either is applied at the base of the tree during the winter. Before the sap starts the trees are usually

headed-back to a whip 18–24 inches high, and all young shoots are afterwards rubbed off except 4 or 5 for the top. Young orchards are usually well cultivated until from August 1 to 15. Aphids, if they attack the top, are destroyed by strong tobacco water or kerosene emulsion. If the aphids attack the roots a handful of



1677. Peach growing in Georgia. View in the Hale orchards, Fort Valley. (See p. 1232.)

good tobacco dust applied, after removing the surface soil, will generally kill them. Orchards are cultivated in corn, potatoes, tomatoes, etc., or any other hoed crop until they come into bearing at 3–5 years; after this they should have the entire ground, with no other crop except crimson clover or cow-peas for humus in years when there is no fruit. Corn is not as desirable as some low-growing, cultivated crop, like potatoes or tomatoes, which can be manured highly and at the same time not interfere with the trees. Under no condition should the trees be seeded in grain or grass, and clean cultivation should be given each year. The trees are usually examined for borers at least once a year and sometimes twice.

The pruning is done in fall or winter. No heading-back of bearing trees is practiced, but no doubt many of the young orchards now being planted will be grown in this manner. Dead wood is removed annually and the top kept open to admit the sun so as to color the fruit. A low wagon is often used for hauling out the brush.

Dissolved South Carolina rock and muriate of potash makes one of the best fertilizers. Raw bone is more expensive, and it is doubtful if it is better than South Carolina rock. From 600–1,000 lbs. may be applied per acre broadcast in the winter or early spring. Wood ashes are good but hard to obtain. Bearing orchards are generally plowed in April, 3–4 inches deep, harrowed thoroughly with a smoothing harrow, and afterward kept in clean culture. The gang-plow and the sulky-cultivator are frequently used. Under favorable conditions orchards live and bear good crops 20–25 years, though the best crops are obtained between the years of five and fifteen.

Thinning of the fruit is not generally practiced in Delaware, but this is one of the problems that is receiving more serious thought and will be given greater attention in the future. In 1900 the trees and prices suffered severely from lack of thinning. The pickers and packers are paid 8–12 cents an hour. In the orchard the fruit is picked in five-eighths baskets, taken to a central packing house where it is carefully graded, then loaded on spring wagons holding about 150 baskets and taken directly to the station for shipment, or for sale to the buyers. The fruit is generally graded into two grades, the first containing the largest fruit, and the second good-sized perfect Peaches. The smaller grades are taken to the canning factories.

In the nursery the trees are always propagated by budding. At one time it was supposed that natural seeds produced the best and healthiest trees, but experience has shown that no trees are better or healthier than those grown from seed taken from the most vigorous orchards.

3. *Marketing.*—Formerly all of the fruit was picked in baskets, packed in crates holding three pecks, and shipped to the commission men of the various markets. At the present time a very large proportion of the crop is sold in five-eighths baskets to the buyers at the railroad station. This method of marketing is the most satisfactory way to dispose of a Peach crop. The buyers generally pay cash, and the grower with the money in his pocket is relieved of all the worry connected with freights, commission men, and the like. Some of the finest fruit is packed in carriers holding 6 baskets, and is sold at fancy prices, either at the station or in the general market. Refrigerator cars, holding 600 to 800 baskets, are used for fruit that requires two days to

reach its destination and plain cars for near-by points. The cost per basket on refrigerator cars to Boston, Providence, Hartford, and other eastern points is about 40 cents, and to New York, Elmira or Syracuse about 35 cents each. In plain cars the cost to New York is 19 cents, and to Philadelphia about 12 cents each.

A large proportion of the smaller fruit is used by canning factories, of which there are one or two in every

1678. Hale Peach tree before pruning. (See p. 1233.)

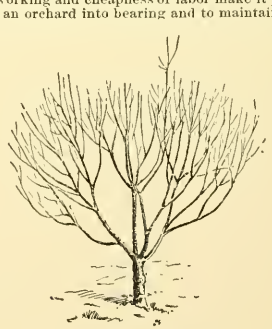
town. A factory in Seaford uses about 3,000 baskets per day when running its full capacity. The Peaches are peeled by women, and the factories of the state employ several thousand hands. Formerly a good many of the smaller Peaches were evaporated, and evaporators were built throughout the Peach-growing belt. The present low price of evaporated fruit and the competition of California and the West have caused this phase of the Peach business to be abandoned. Numerous factories have converted large forests of gum and of pine trees into carriers and baskets. In 1900 the baskets cost from 3 to 3½ cents and carriers from 14 to 17 cents each.

4. *Varieties.*—In no other fruit have the standard orchard varieties changed more than in the Peach. Many of the Delaware orchards planted not more than ten years ago are now unprofitable because varieties in demand then are now out of date. Formerly the white Peaches, such as Oldmixon and Mountain Rareripe, were in strong demand; now the call is for yellow fruit, and the finest white varieties have to be sold at low prices. Early kinds also used to pay, but now they come in competition with the best varieties from Georgia. Late varieties, which were also very profitable, are now ripe when the best fruit from New York, New Jersey and western Maryland is in the market. The old orchards comprise Troth, Hale, Crawford Early, Mountain Rose, Reeve, Oldmixon, Mt. Rareripe, Crawford Late, Stump, Smock, Couper Late, Garey Hold-on, and others, and as in other fruits, most of them contain too many kinds. A large proportion of these old kinds have to go to the canning factories at low prices whenever there is a general Peach crop, as the market will not take them. In the new orchards the yellow fruit will predominate, with a few white varieties. Probably the kinds most often found in orchards under five years old are Foster, Mountain Rose, Reeves, Oldmixon, Moore Favorite, Elberta, Chair Choice, Crawford Late and Smock. The Elberta is being planted more heavily than any other variety. If the writer were to set a new orchard his own choice would be as follows: Connett Early, perhaps Mountain Rose, Foster, Reeves, Elberta, Chair, perhaps Crawford Late, Prize and Townsend. Nearly all growers would always include Crawford Late, and many of them Moore Favorite and Thurber.

Of the newer varieties in Delaware, Connett Early, Carman, Waddell, Greensboro, Champion, Mamie Ross and Lady Ingold are the most promising, with preference for the first three and the fifth and sixth. The Delaware Experiment Station has an experimental orchard of 300 varieties ten years old at Seaford, on the writer's place, and another orchard of 75 varieties at Bridgeville, most of which fruited in 1900. In the Seaford orchard a number of Tasmanian trees were planted to determine their orchard value and their susceptibility to Peach yellows. A number were also planted at the Delaware Experiment Station grounds and in other parts of New Castle county. In Sussex county they are vastly inferior to home-grown stock in the quality of the fruit and in the growth of the trees, while in New Castle county they practically all died from the yellows.

5. *Peach Yellows.*—The yellows swept the orchards out of New Castle county and from the northern part of Kent county, but it has not advanced for ten years much beyond the borders of northern Sussex. The most intelligent growers hold it in check by cutting out the trees on the first indication of disease and burning them, but there is no systematic attempt on the part of all growers, nor on the part of the state, to stamp out the trouble. There is a yellows law on the statutes, but it is not enforced, though in the past its enforcement did much good. For several years the disease has not been so severe, though there has been a good deal of complaint about it in 1900. New orchards are again being planted on a large scale in Kent county and some are again planting around Middletown in New Castle county. Many believe that the yellows has run its course in Delaware, and that by careful attention in taking out trees the Peach can again be set in places where the yellows has wiped out the orchards.

6. *General Remarks.*—The geographical location of Delaware is such that no other market can approach it in nearness to the great consuming centers. It is at the gateway of the greatest cities on the continent. One night on the railroad will reach most of them, and two nights all of the desirable markets. The soils are excellent, heavy in northern Delaware, a medium loam in the central part, and a sandy loam in Sussex county. It is easily and cheaply worked, not stony, and responds kindly to treatment. Of the new lands, those recently cleared of chestnut and sassafras are preferred, but pine-land makes excellent orchards. Crimson clover, cow-peas or other cover-crops grow readily and furnish humus and nitrogen to the soil, and with the natural ease of working and cheapness of labor make it possible to bring an orchard into bearing and to maintain it at a



1679. Hale tree after pruning.

very low cost. Late spring frosts are the most serious drawback to the business. Sometimes several crops will come through in succession, then for three or four years the crop will be killed. In the past decade there have been four crops in the state. Other drawbacks are the large orchards, making intensive culture without a large capital impossible, while still another is the tenant system of working the land, which makes it difficult

to introduce into general practice the most improved methods of culture.

The Peach business on the whole has been profitable to Delaware. The days, however, when fortunes were made from a single crop, when a farm was bought or a large mortgage lifted in a single season, have passed. Once those times were known in Delaware, but that was before Georgia, the Carolinas, Arkansas, the Ozark region of Missouri, Michigan, New Jersey, New York, or Connecticut had entered into the business on their present scale. Peach-growing is still attractive to planters in Delaware. More money can be made in it than in general farm crops. More attention is being given to the selection of varieties, to the care and planting of orchards, the picking and handling of the crop, and, last but not least, to the marketing of the fruit, with as many middlemen eliminated as modern business methods will allow.

Peaches Carried by Pennsylvania Railroad, Delaware Division.

Year.	Baskets.	Year.	Baskets.	Year.	Baskets.
1867	1,233,600	1879	2,598,000	1890	5
1868	13,800	1880	2,050,200	1891	3,196,717
1869	2,411,400	1881	46,800	1892	265,893
1870	1,624,200	1882	2,731,770	1893	4,208,596
1871	3,200,400	1883	1,785,447	1894	29,620
1872	2,454,000	1884	1,936,617	1895	2,100,334
1873	1,721,800	1885	1,870,496	1896	3,513,413
1874	759,000	1886	1,099,738	1897	234,876
1875	5,443,200	1887	818,347	1898	173,502
1876	1,721,200	1888	3,177,447	1899	3,157
1877	2,401,800	1889	840,577	1900	2,634,203
1878	521,400				

The figures for 1900 include the peninsula, but not two small side lines. It is estimated that 1,000,000 baskets were carried by other means and that 500,000 were used by the canneries. Probably two-thirds of the Peaches included in this estimate were grown in Delaware.

CHARLES WRIGHT.

THE PEACH IN CALIFORNIA.—There is no distinct Peach belt in California, but the Peach is grown successfully over a wide area and under varied climatic conditions. Tourists generally talk of "the California climate" as if it were one thing, but a glance at the article *California* in this work will give the reader some idea of the immense variety of climate and crop conditions.

A narrow strip along the coast is too cold for the best quality of Peaches, even where frost is unknown. A very few miles inland and up to an elevation of 2,000–3,000 ft., the Peach is at home when the grower has done his part. In a large part of the state the best results are attained only by irrigation. In some places no rain falls from the time the trees bloom until the latest fruit is gathered. There are some localities, however, where the water in the soil is close enough to the surface to give an ideal supply of moisture without irrigation. It is an odd fact that Peaches in the central part of the state ripen before those in the southern part. The time of ripening in the extreme southern part does not vary much from that of southern Ohio, while 500 miles north in the Sacramento valley they ripen two to four weeks earlier. In some of the warm foothill regions, Alexander begins to ripen the latter part of May.

All kinds of care are given orchards, as one will find in any state, but on the whole orchards probably receive much more attention in California than elsewhere in the United States. The successful orchardist has learned well the lesson that there is room at the top. The less careful have learned that there is little money in the orchard business.

In the preparation of the soil, deep plowing is all that is usually done. California soils are generally about the same all the way down, but vary much in depth. Good Peach orchard soils should be not less than 4 feet deep, and a greater depth is desirable.

The trees are usually planted 20–25 feet apart. In the southern part of the state the best practice is to grow nothing between the trees, even the first year. The tillage is thorough, deep and frequent. After February 1, tillage is given in two directions after each rain, care being taken to complete the work before the soil can bake or get hard. This double cultivation is kept up at least once a month after rains cease, which is usually in March. Thorough surface tillage is practiced after each irrigation. Tillage may be much deeper without injury in California than in most states, for the reason that there is a much warmer subsoil which permits the roots to go down deeply to reach the moisture necessary to carry them over the long periods without rain or irrigation. Orchards should be perfectly free of weeds from March 1 to the end of the growing season. Clean tillage is not sufficient. The ground must be in fine tilth from 4–6 inches deep and kept so all summer.

The low-headed tree has the preference. At planting, the nursery tree is cut back to 12–18 inches. The first six weeks after growth begins the trees are gone over at least once a week to rub off all sprouts that are not desired. Four or five are left to form the main branches; these should be as evenly distributed around the tree as possible. Also they should be as far apart in a vertical direction as possible, as two growths should not come from one place. Three or 4 feet of new growth for each branch the first year is considered fair. The first pruning occurs the following winter. About three-fourths of the season's growth is cut back and all small shoots are taken off from what is left. This facilitates even and better growth of the secondary branches that start the second year. There should be 2–3 of these branches from each primary branch, being careful to keep all others rubbed off by at least weekly visits to the tree for a month or more after growth begins. The second winter's pruning consists in cutting back one-half to three-fourths of the length of the main growths and cutting out most of the small side shoots. A few are left to bear some fruit the third year. Each fall or winter at least one-half the length of the main growths is cut back and a number of the remaining small bearing shoots are taken out. If these bearing shoots have plenty of fruit-buds near the base, it is best to cut off one-half the length of these. If they have no fruit-buds near the base (as they are not likely to have if the tree is growing very fast) they are left whole. This cutting back of the bearing shoots aids very much in the thinning of the fruit. The best practice is to cut out all shoots which fruited the previous season. They nearly all die anyway. The tree looks much better without them and is supposed to be more healthy. Nothing short of severe pruning secures the best results under ordinary circumstances.

There is no single operation of more importance than the thinning of the fruit, even after such thorough pruning as above described. There are many methods of thinning. The one that can be communicated the easiest and possibly the best (because any one can do it) is to pull off all but two Peaches from each bearing shoot. A dozen or more may be on the shoot, but they must be taken off. The usual size of such shoots is about an eighth of an inch in diameter. If they should be about ¼ inch in diameter, three or four Peaches are left. The time to thin is when the Peaches are about ⅔ inch in diameter. At this size they are likely to remain on the tree (the "May drop" being past), and if thinning is promptly done the tree's waste of strength will be small. Those who think this is severe thinning should remember that any fruit, both in bulk and weight, is eight times as large as one that has only half its diameter. The above method of pruning and thinning saves the tree from breaking down. The fruit is all marketable. The tree makes a good growth and is in fine condition for the succeeding crop. And, finally, it pays.

The varieties planted in California are largely Foster Early and Late Crawford, Muir and Salway for freestones. The Orange and Lemon Clings, for clings, are largely used by the canneries. Levi Cling is largely planted in some of the foothill regions. There are many other varieties planted in a small way. Some of the newer kinds give promise of taking a place among the regulars. A good variety of Peach for California must have large fruits and plenty of them, which will ship well and dry well. White Peaches are but little used. The canneries are paying the best prices for good yellow clings.

Three or four irrigations, about a month apart, are usually given. The furrow system is the prevalent one.

Three to six furrows are made between the rows of trees, and in these the water runs in a small stream 24–48 hours for each irrigation. The length of time depends on the soil, some soils taking in water much more freely than others. The amount applied each time should equal a rainfall of 3 or 4 inches. One irrigation after the crop is off is excellent for the succeeding crop. There are four ways of disposing of the crop—drying, shipping, local markets and canneries — though it is seldom that all of them are available in one locality. The usual net return to the grower is a little less than one cent per pound for the best fruit.

Drying is the largest opening for the disposal of the crop. The drying is all open-air sun drying, requiring 5–8 days to complete the work. The fruit is all well sulfured after cutting. The time required for exposure to the sulfur fumes is 3 or 4 hours. For best results the fruit should be just about ripe enough to eat. Drying without sulfur would make the business unprofitable as market standards now are. The sulfuring preserves the color and quality of the fruit. Ripe fruit dried without it would be black and taste burned. In cooking sulfured fruit first apply hot water for a minute or two, then pour off, cover the fruit again with water and after half an hour or more pour off again. Fruit cooked in this way may be eaten in quantity without any bad effects, and there will not be enough sulfur even to tarnish the silverware. The usual net price to the drier is 5–7 cents per pound for Peaches dried from large, well-ripened fruit and well sulfured to preserve a fine color.

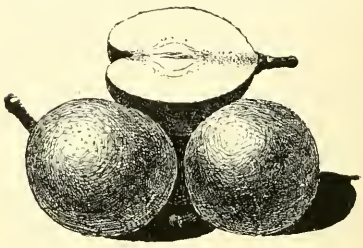
H. Culbertson.

PEACOCK FLOWER. See *Poinciana regia*.

PEANUT is described under *Arachis hypogæa*, but Peanut culture is not included in this work because Peanuts are an agricultural, rather than a horticultural crop. See Farmers' Bulletin No. 25, U. S. Dept. Agric., by R. B. Handy, 24 pp., 1896.

1680. The Sand Pear, Pyrus Sinensis (×⅛).

PEAR. Plate XXVII. The cultivated Pear, as known in North America, is derived from two distinct sources, the European *Pyrus communis* and the Oriental *Pyrus Sinensis*. Pears of the European stock have been grown in North America from the earliest settlement of the country. They thrive particularly well in the New England states and New York, and west to the Great Lakes, and again on the Pacific slope. In the great interior basin, Pear culture always has been precarious, due primarily to the great liability of the trees to blight. In the southern states, the climate is too hot for the best development of the tree and the best quality of the fruit. In the north prairie states, the winter climate is so severe that the Pear tree will not grow. Some time before the middle of the century the Sand or Chinese Pear (*Pyrus Sinensis*), Fig. 1680, was introduced into the eastern states, although it attracted little attention. It soon hybridized with the common Pear, and a race of mongrel varieties was the result. Of these hybrids only two have gained great commercial prominence. These are LeConte and Kieffer. Figs. 1681–3. The LeConte was found to be well adapted to the southern states and its general introduction there after the close of the civil war was the beginning of commercial Pear culture in the south. It was first supposed to be blight-proof, but in recent years the orchards have been nearly decimated by the blight with the result that the LeConte is gradually lessening in importance and its place is being taken by the Kieffer, although the latter is by no means blight-free. The Kieffer Pear originated with Peter Kieffer, of Roxborough, Philadelphia, an Alsatian gardener, who died in 1890. He grew the Chinese Sand Pear and sold the seedlings as ornamental trees, for this species is of very distinct and handsome growth and the fruit is ornamental and fragrant. Alongside the Sand Pears were Bartletts. Amongst one of the batches of seedlings from the Sand Pear he noticed a plant with different foliage, and this he saved. Its fruit was found to be superior to the Sand Pear, and it was introduced as the Kieffer. The Kieffer Pear is now very popular in many parts of the country because of its great vigor, healthfulness, productiveness, and the keeping qualities of the fruit. In point of quality, the fruit is distinctly inferior, but it meets the demands of the market and is an excellent fruit for canning. In the cold prairie countries and other parts of the cold north, Russian Pears have gained some headway in recent years. These are merely hardy types of *Pyrus communis*. The fruit is usually of low quality, but the trees are considerably hardier than the ordinary Pear. *Pyrus Sinensis* itself bears a very hard Pear which is inedible in the raw state, but it is excellent when used as quinces are. It is fragrant and ornamental. The tree is a most vigorous and clean grower. The plant is well worth growing as an ornamental. It is used for stock for ordinary Pears, particularly in the southern states. See *Pyrus*.



1681. LeConte Pear (×¼).

The Pear thrives on a variety of soils, but it succeeds best on those which are rather hard clay. On sandy and loamy lands it tends to be short-lived. This is due, in part, to the fact that trees grow rapidly on such lands, and are, therefore, more liable to the attacks of blight. It is now generally accepted that trees which are making a strong and soft growth are more susceptible to blight than those which grow rather slow and firm, although all trees are liable to attack. Some varieties are much more immune than others. Caution must be exercised, therefore, in the tilling of the Pear orchard. Whilst Pears profit by the best tillage, as apples and potatoes do, it is easy to carry the tilling and fertilizing so far as to produce too vigorous growth and thereby invite

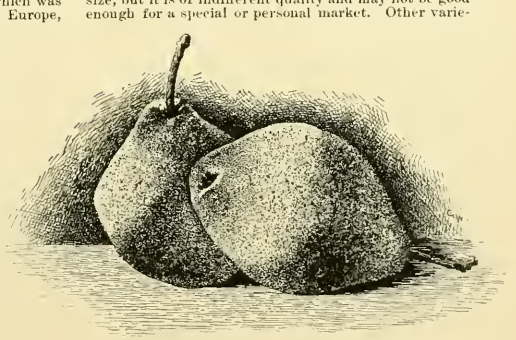
the blight. Therefore the most careful Pear growers use sparingly of stable manure and of nitrogenous cover-crops. They prefer to supply fertility by means of concentrated fertilizers which are not very rich in nitrogen. If, however, the trees are not making a strong and steady growth, it is as necessary to apply nitrogenous fertilizers to the Pear tree as to any other. In the interior country, Pears are likely to suffer from sunscald, and therefore the tops are started very low, usually not more than two or three feet from the ground. Standard Pears are pruned much as apple trees are, except not so severely. Heavy pruning tends to open the top and to invite sun-scald, and it also tends to make too strong and sappy growth. After the top of the Pear tree is well formed and established, it is customary to do little pruning, only keeping the top fairly free and open. The Pear bears on spurs which continue to branch and to bear for a number of years, and in pruning it is important that these spurs be not removed unless it is desired to thin the fruit. The flowers are borne in umbel-like cymes (Fig. 1684), but in most cases only one fruit sets in a cluster. Pear trees are usually planted much closer than apple trees. The customary distance is 18–20 feet. Fig. 1686 shows an average east-American Pear orchard.

1682. Section of the Kieffer Pear, to show its ordinary form in the North.

Many of the varieties of Pears are infertile with themselves: they need the pollen of other varieties in order to cause them to set fruit freely. Probably any variety will fertilize any other variety in case the two bloom simultaneously. Such varieties as Kieffer and Bartlett are usually classed as self-sterile kinds, but the degree of sterility varies in different places and with different conditions. The safest plan in the setting of a Pear orchard is to plant not more than two rows of one variety together, and to alternate with one or two rows of another variety.

Good varieties of Pears are numerous. The one most important variety is the Bartlett (Fig. 1685), which was early introduced into the United States from Europe, where it is known as the Bonchretien. At the present time the Kieffer probably holds second place. In the eastern states, the Seckel (Fig. 1687) is a prominent variety, and is the standard of quality. Other prominent varieties are Anjou (Fig. 1688), Clairgeau, Hardy, Howell, Sheldon, and Diel. The list might be almost indefinitely extended. In the Gulf region the oriental hybrids alone are successful, and the leaders are Kieffer, LeConte, Garber, and Smith. The season of the maturity of Pears runs from midsummer, when it is introduced by Summer Doyenne and Manning Elizabeth, to late winter, when it is closed with such late winter varieties as Nelis, Josephine de Malines and others. The winter Pears are relatively little known in the eastern states. As a rule, they come into bearing late or are not very prolific; but there is no reason why they should not be better known. Winter Pears are kept as winter apples are, although somewhat greater care is necessary. They should be kept in a uniformly cool temperature. If allowed to hang too long on the tree, they become over-ripe; and then if placed in an ordinarily warm cellar, they do not keep more than one or two months. Unlike most other fruits, all Pears are greatly improved in quality if they are ripened indoors. They should be picked as soon as they have reached their full size and have begun to color, but before they have become soft, and be placed in a dry and rather cool room. If the wind is allowed to blow over them, they are likely to shrivel. If kept too warm, they ripen too quickly and soon rot. The best quality is secured when they are picked about two weeks in advance of their normal ripening.

When worked on the quince root, the Pear is easily grown as a dwarf. It then comes into bearing earlier, and, since the trees are small, the fruit can be thinned and the trees sprayed, and the fruit therefore should be of the highest quality. Dwarf Pear trees require more care than the ordinary standards, however, and they should not be planted unless the cultivator understands this fact and is willing to give the attention that they need. Although the trees are by nature dwarf, since they are worked on a smaller-growing species, they nevertheless tend to become half standard if left to themselves. Therefore they must be very severely headed-in every year. A dwarf Pear tree should never reach a greater height than twelve feet. In order to keep it down to this stature, from one-half to two-thirds of the annual growth is removed late each winter. The trees are often planted as close together as ten feet each way, but this is too close. With the ordinary broad-top pruning, which nearly all American growers give, one rod apart each way is not too great. A good dwarf Pear tree is one in which the union with the quince stock is very close to the ground. When the tree is planted, this union should be from four to six inches below the surface after the ground has settled. This deep planting prevents the breaking of the union and places the quince beyond the reach of borers. If planted deeper than this, the Pear cion may throw out roots of its own; in fact, it sometimes does this if planted only six inches deep. This rooting of the stock is no particular disadvantage, although the tree thereafter tends to grow stronger and greater pruning is necessary. An expert grower can pick out the trees which are rooted from the Pear stock by their more vigorous growth: if he desires to check this redundant growth he may cut off the Pear roots. It is the common opinion that dwarf Pear trees are short-lived. This may be true as regards the greater number of specimens which one sees about yards and on untilled areas, but a dwarf Pear orchard on good, well-drained ground, which is well-tilled and given regular pruning, will last a lifetime. There are dwarf Pear orchards in New York state which are fifty years old and are still thrifty and productive. The variety that is oftenest grown as a dwarf is the Duchess (Duchess de Angouleme). Fig. 1689. This is a large Pear of irregular shape which sells well because of its size, but it is of indifferent quality and may not be good enough for a special or personal market. Other varieties popular for dwarfs are Louise Bonne, Anjou, Clairgeau, Manning Elizabeth, and, to a less extent, Bartlett and Seckel. The Kieffer is now and then grown on dwarf stock with very good results.



1683. The Kieffer Pear, now one of the most important commercial varieties ($\times \frac{1}{4}$).

The insect enemies of the Pear are numerous, but,

with two or three exceptions, are not very serious. The tree is attacked by borers, although to a less extent than peaches and apples. These are kept in check by digging them out once or twice a year as on other fruit stocks. The fruit is attacked to some extent by the codlin-moth, but the arsenical sprays keep this insect in check. Of late years the psylla, attacking the growing parts, has been serious in parts of the East, although it is very irregular in its outbreaks. It can be controlled by thorough work with a spray of whale-oil soap, one pound in three to five gallons of water, beginning soon after the fruit has set, and repeating the application whenever the psyllas become numerous. In some parts of the East the fruit is attacked by the Pear midge, a minute fly whose maggots work in the very young fruit. Thorough cultivation will check this serious pest, but its complete control often involves the destruction of all the young fruit on the infested trees; in some sections the application of kainit to the soil is said to kill the insect after it leaves the fruit to undergo its transformations.

1684. Cluster of Pear flowers. ($\times \frac{1}{3}$).

The foliage and fruit of the Pear are attacked by parasitic fungi, which cause the leaves to drop and the fruit to become scabby. These diseases are readily held in check by spraying with Bordeaux mixture. Fifty years ago the White Doyenne Pear was the most popular variety for growing on the quince root, but because of the Pear scab it passed away. It was supposed that the disease was due to uncongenial climate. Since the advent of the sulfate of copper sprays, however, it has been found that the White Doyenne can be grown as well as ever. Flemish Beauty is also an example in point. Years ago it was one of the most popular standard varieties, but of late years it has been little grown because of the cracking of the fruit. It is now likely to come into vogue again for home planting. The Bordeaux mixture is a specific for the disease.

Pear blight or fire blight is the most serious disease of Pear trees. It is an American disease. It is caused by a microbe which enters through the growing points (flowers and tips of shoots) and thrives in soft or "succulent" parts. Gradually the micro-organism works down the stems, killing the tissues and causing the leaves to die. In the leaf-blight, which is a distinct disease, the leaves are more or less spotted and they fall; in the Pear blight, the leaves turn black and hang on the tree. The fire blight attacks apple trees, particularly in the Plains region. It is probably aboriginal on hawthorns and related plants. There is no perfect preventive of the disease. Some varieties seem to be relatively immune, as, for example, the Duchess. It is now generally believed that trees are more subject to the disease when they are making excessive growth; therefore it is advised that tillage and the application of stimulating manures be moderate. As soon as the disease appears, cut out the affected parts, severing them some inches below the lowest point of visible attack. Do not allow blighted branches to remain on the tree over winter. Pear blight is not equally prevalent or virulent every year.

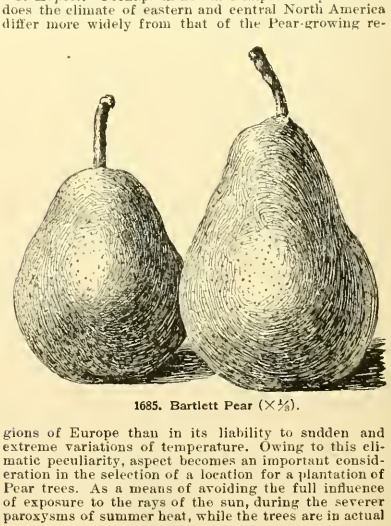
There are no recent American books on the Pear. Two books have been written on this fruit: Thos. W. Fields' "Pear Culture," New York, 1858; P. T. Quinn's "Pear Culture for Profit," New York, 1869, New ed., 1883.

Some years ago the writer secured from the venerable T. T. Lyon, of Michigan, since deceased, an article, for publication, on the Pear. The article was not published, however, and it is reproduced below, omitting only the parts on insects and diseases. The writer is glad to place this article alongside the others in order to contrast the view-points of two generations. Mr. Lyon's article, which is most excellent and cautious and characterized by beauty of style, is of the type that we no longer see. The person who is familiar with present-day points of view will discover that it lays the emphasis on formal presentation, propagation, pruning, varieties, whereas little or no attention is given to systems of tillage, pollination, spraying, and commercial methods. L. H. B.

THE PEAR. 1. *Its Importance.*—So far as cultivators generally are concerned, this fruit is less important than its near relative the apple, for the reason that, while the two begin to ripen at nearly the same season, there are few, if any, desirable varieties of Pears in season later than December (if we except a few austere ones, suitable only for culinary purposes), while apples are abundant for four or five months longer. Moreover, during its entire season, the Pear is supplemented by the mass of luscious, though perishable, summer and autumn fruits. The liability of very many usually excellent varieties to be rendered indifferent in quality by unfavorable seasons, neglect or unsuitable soil, is also a serious detriment to the general popularity of this fruit. The liability to the loss of the trees by blight, beyond question detracts greatly from the value of the Pear, especially for commercial purposes; while it also exerts a discouraging influence upon amateur planting. To the careful and discriminating amateur, as well as to the man of wealth, with a fondness for fruit culture, whether in person or by proxy, this fruit often assumes a prominence over any, if not all, others.

2. *Extent of Cultivation.*—Doubtless, for reasons heretofore stated, Pear trees are but sparingly planted by most persons. The fruit sent to the market comes largely from the plantations of specialists who, with soils adapted to the purpose and the necessary knowledge of varieties, have undertaken the business as a commercial enterprise. In the climates of the seaboard, and, to a considerable extent, in the region of the Great Lakes, the Pear is exceptionally successful; while away from the influence of large bodies of water, and especially in the prairie regions of the Mississippi valley, from unsuitableness of climate or soil, or both combined, the trees are liable to be either killed or seriously injured in winter, and hence are short-lived and unprofitable.

3. *Aspect.*—Perhaps in no other important particular does the climate of eastern and central North America differ more widely from that of the Pear-growing re-



1685. Bartlett Pear ($\times \frac{1}{3}$).

gions of Europe than in its liability to sudden and extreme variations of temperature. Owing to this climatic peculiarity, aspect becomes an important consideration in the selection of a location for a plantation of Pear trees. As a means of avoiding the full influence of exposure to the rays of the sun, during the severer paroxysms of summer heat, while the trees are in actual

growth, and also to mitigate the liability to alternate freezing and thawing in winter, a northerly or northeasterly slope is to be preferred; which, however, should be so gradual as not to seriously interfere with the convenience of cultivation. As we approach the northern limit of practicable Pear culture, however, a modification of this rule of selection may be found desirable, since, with the shorter growing season, a warmer exposure may prove necessary as a means of hastening maturity.

4. *Soils.*—While the Pear tree will yield more or less satisfactory results in a variety of soils, it is found to succeed most perfectly in a strong loam, of moderate

1686. Orchard of standard Pears as grown in the northeastern states.

depth, overlying a porous subsoil. Soils which are liable to be wet during any considerable portion of the growing season are unfit for this purpose, unless deeply and thoroughly underdrained; while even then they are quite liable not to prove fully satisfactory. A few varieties are found to be moderately successful on sandy soils, but for general planting such soils should be avoided.

5. *Manures.*—The liability of the Pear tree, in this climate, to the attacks of blight is thought to be increased by excessive growth. It is, therefore, desirable that the annual growth be completed and ripened at as early a date as practicable; and the more so, since the liability to blight apparently exists only while growth is in actual progress. Stable and other nitrogenous manures should, for this reason, be applied in moderate quantities, in autumn, after the liability to excite renewed growth shall be past. Potash, lime and phosphorus, which enter more or less largely into the composition of both tree and fruit, and which rarely exist in excess in the soil, may be profitably applied in either autumn or spring. Salt may also be profitably applied to the comparatively dry soils recommended for the Pear, but with care not to apply in excess. One or even two quarts may be safely applied to each tree, before the commencement of growth in the spring, if well distributed upon the surface over a space of at least 6 or 8 feet in diameter, and left to be carried gradually into the soil by dew and rain. It is believed to possess little, if any, manurial value; but to act rather as a conservator of moisture, and probably also as a repellent of insects. Coarse mulch may be placed about the trees, covering the soil as far out as the roots extend, for the purpose of keeping the earth cool, and also to check evaporation from the soil; but this should not be done as a substitute for cultivation; and the soil beneath the mulch should be kept well pulverized.

6. *Propagation.*—(*a*) By seedlings: Seeds, when to be planted for the origination of new varieties, should be selected from well-grown and fully matured fruits, of such varieties as possess in a high degree the qualities sought to be reproduced or improved, since a variety in which a characteristic is strongly developed and persistently manifested is the more likely to transmit such peculiarity to its offspring. Seeds resulting from known or artificial cross-fertilization, and therefore of known and selected parentage on both sides, offer increased probability of valuable results. Seeds intended for the origination of new varieties should be planted very thinly in strong, rich, deeply prepared soil, in a single row, and covered with not more than an inch of earth, so that the young plants shall have ample space for development.

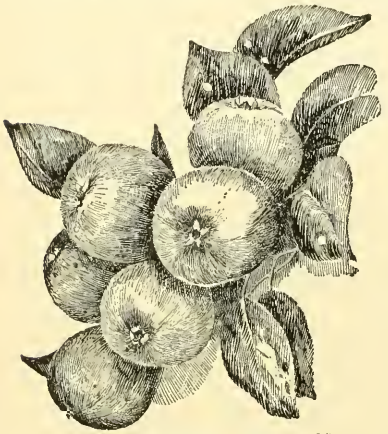
Seeds intended for the growing of stocks for nursery purposes should be collected from varieties in which the seeds are plump and well developed, as well as from healthy, vigorous trees. American nurserymen obtain Pear seeds mostly from Europe. Seeds intended for nursery stocks are usually planted in broad, shallow drills. In our American climate the foliage and unripened wood of seedling Pears is very liable to be attacked during midsummer by leaf-blight or mildew, which prematurely arrests their growth. For this reason European stocks are generally preferred by nurserymen. This attack of mildew may often be partially or wholly avoided by planting in virgin soil remote from other cultivated grounds. Pear seedlings form a very long tap-root during their first year, with few, if any, side-roots. For this reason they are taken up preferably in autumn, and the tap-roots shortened to 6 or 8 inches, when they may be replanted in nursery rows, and earthed up, or otherwise protected from heaving, or other injury during winter; or, preferably, they may be heeled-in, in a frost-proof cellar, and planted in spring, to be budded during the ensuing summer or left to become more fully established for budding a year later.

Seedlings intended for fruiting are usually transplanted in rows, about 8 feet apart each way, with the expectation that many will be found worthless, and either removed or destroyed. Seedling Pears usually require to be fruited several years before their characteristics become fully developed. This generally recognized fact may be taken as a warning that the occasional effort to hasten the puberty of a seedling by fruiting a cion from it upon a bearing tree of different variety cannot be trusted to indicate the ultimate character of the fruit of the yet incipient variety, since it is impossible to foresee to what extent such transfer may interfere with the occult formative processes through which its ultimate qualities would have been developed.

(*b*) By budding: Seedlings of one or two years' growth, intended for standard trees, are usually planted from 6 to 10 inches apart in the nursery row; for the reason that space, as well as cultivation, must be economized to correspond with prices, although it is impossible to grow trees of good form and properly branched of the size and age demanded by most planters when thus closely planted. Trees thus closely planted should be removed, or at least thinned, after having made one

year's growth from the bud; while trees intended to be grown two or more years in the nursery row, and properly branched, should be given twice or even three times the space mentioned.

The budding of Pear stocks may be done during July and August if they continue in a growing condition, but they are liable to be attacked by mildew of the foliage, for which reason they must be closely watched,



1687. Seckel, the standard of quality (×½).

and should the malady prove troublesome the budding must be done as soon as properly matured buds can be obtained. Such stocks as, for any cause, were left unbudded at budding time, together with any in which buds shall have failed, may be grafted the following spring; but this, as well as any and all grafting of the Pear, must be done very early, before the earliest movement of the sap in spring. In the spring, as soon as the swelling of the buds indicates that the germs are alive, the stocks are cut back to force them into growth. Often to insure the formation of straight, upright, symmetrical trees, careful nurserymen leave 3 or 4 inches of the stock above the insertion of the bud, to which the young shoot may be tied, if it shall fail otherwise to take an upright direction. Shoots may also be thus tied to prevent their being blown out, or otherwise injured by the wind. These stubs should be cut back to the bud when no longer needed for the purposes indicated. Such sprouts as spring from the stock in consequence of the cutting back must be removed from time to time to encourage the growth of the bud. This should be done while they are yet tender and succulent and can, therefore, be taken off without the use of a knife. This process must be repeated as they reappear, unless it is rendered unnecessary by the failure or loss of the bud. See *Grafting*.

7. *Pruning.*—Beyond that described under the head of budding, little pruning is required during the first season, except to pinch in such side shoots as threaten to rob the one intended to become the trunk of the future tree. Early in the spring of the second year, all lateral shoots must be wholly cut away, and since the Pear tends strongly to renew its growth from the terminal buds of the previous year, the shoot intended to become the trunk of the future tree must be cut down to the point at which the top is to commence, when the branches to form the head will start from the buds nearest the top. The uppermost shoot must, if needful, be confined in an upright position to constitute the continuation of the trunk.

The habits of growth of varieties differ so widely that no inflexible rule can be laid down to determine the height at which the top of a Pear tree should be commenced, unless it be that the heads of the more spreading varieties should be started higher than those of a more upright habit. The preferences of the majority of purchasers have begotten among nurserymen the practice of forming the heads of all varieties at a height of 3 or 4 feet. This height is open to the objection that, while not seriously faulty in the case of such spreading varieties as Onondaga, Osband Summer, or Flemish Beauty, it is essentially unsuited to such very upright growers as Buffum, Sterling, Clapp Favorite, and even Anjou. In this particular, as in various others, the practice of nurserymen, begotten by the preferences of the average of their customers, fails to adapt itself to the needs of the more intelligent and considerate orchardist, and to those of even smaller planters, who regard the health and productiveness of their trees as of higher importance than the possibly increased convenience of cultivation.

A proper system of primary branches, upon which to grow a permanent head, should be provided from the growth of the second season. Probably the most satisfactory provision for this purpose consists of a central shoot, with from 3 to 5 laterals diverging from the trunk at its base. A head should, in no case, be grown upon two shoots, forming a crotch, since this will be very liable to split and thus ruin the tree. A few varieties, of which Rostiezer is a notable example, have the habit of producing but few branches, and also of making successive annual growths, mainly from the terminal buds of the previous year, thus forming a too open or straggling head. Such tendency is best overcome by cutting back the branches in spring, the effect being to increase their number, though at the expense of vigor.

After the primary branches have been developed, and the growth of the third year is in progress, comparatively little pruning will be found necessary beyond the occasional cutting away of a straggling or crossing branch, although there is a class of varieties, of which Summer Doyenne and Winter Nelis are types, which, especially when growing vigorously, incline to twist and straggle so awkwardly that the branches must frequently be tied in position to insure the formation of a satisfactory head.

Prior to the third or fourth year, all pruning must necessarily have for its object the direction and encouragement of wood growth, for which purpose it is most effective when performed in late winter or early spring, while the trees are yet dormant.

The fact should not be forgotten that pruning, in proportion to its extent or severity, may be a tax upon the vigor and health of the tree, and, therefore, to be practiced as sparingly as possible. Such necessity may be to a considerable extent avoided, if the orchardist, with a well-defined ideal in mind of a tree such as he desires to produce, will, during the growing season, pass frequently through his plantation and pinch out, while yet small and succulent, all growths not needed for his purpose, at the same time "stopping" such of the reserved ones as may be too far outgrowing their fellows. With the efficient performance of this process while the framework of the top is being developed, very little pruning will remain to be done on the arrival of spring, while nearly the entire growth, which would otherwise have been pruned away in spring, will have been employed in developing the reserved branches.

While the cutting away of an occasional small branch may be done at almost any time, large branches should be removed only in case of actual necessity, and at a period early enough to permit the thorough drying and hardening of the cut surface prior to the movement of the sap in spring, as a means of preventing bleeding and consequent decay.

Summer pruning tends to check rather than encourage wood growth, and since it acts to a greater or less extent as an obstruction to the circulation, it also tends, as does the permanent bending of the branches and the hardening of the tissues, to hasten the formation of fruit-buds and the production of fruit.

The Pear may be successfully grafted upon the white thorn, the mountain ash and the apple, and such grafts have occasionally proved more or less productive for a time, but in such cases the union between stock and

Plate XXVII. Pears

Louise Bonne in the dish; Angouleme (Duchesse d'Angouleme) on the table. One-half natural size

cion is generally, if not always, imperfect; and such uncongenial combinations are therefore usually short-lived. The quince is the only dissimilar stock upon which the Pear is extensively grown. Quince stocks for this purpose are largely imported from France. The Angers quince is generally preferred for this purpose. These stocks are usually planted in nursery rows at the age of two years, to be budded during the following summer, in the same manner as Pear stocks. When intended for dwarf trees, nurserymen usually cut them back after one year's growth from the bud to the nearly uniform height of 18 inches, although with the more upright-growing varieties it is by many deemed preferable to branch them even 6 or 8 inches lower. Aside from the height at which they should be branched, the pruning and management should be identical with that prescribed for standards, with the important exception that when planted out for fruiting the junction between the quince and the Pear should be 3 or 4 inches below the surface to encourage the formation of roots from the Pear. Trees thus planted will commence to bear, while yet growing, solely from the quince stock, and will continue to produce fruit after rooting from the Pear, thus affording the early fruiting of the dwarf, as well as the permanency of the standard.

Not more than a specimen or two should be permitted to grow upon a dwarf the first and second years after planting. Such trees, if left to fruit freely, will almost certainly be ruined from overbearing before they are fully established. Many varieties when grown as dwarfs can never be safely allowed to mature more than a small portion of the fruit which they will naturally set.

While several varieties are found to be especially successful when grown upon the quince, most others prove only moderately so, requiring careful and expert management to insure satisfactory results. A few others, of which Bosc may be named as a prominent case, are obstinately unsuccessful upon the quince, and even when double-worked upon a dwarf of a congenial variety, their success appears to be by no means assured.

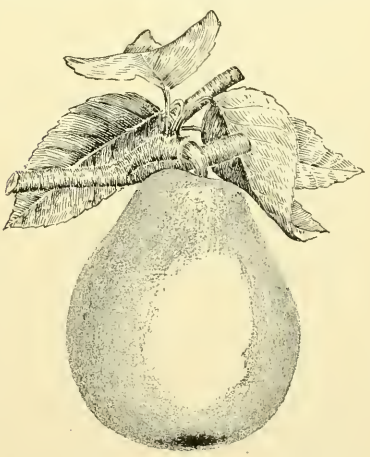
Dwarf trees trained as hereinbefore specified, are commonly known as half-standards. Other and more elaborate forms are known as pyramids, cordons, etc., descriptions of which are not deemed necessary here.

8. *Choice of Trees.*—Aside from the selection of the location for an orchard, the first important particular is the selection of the trees, leaving the choice of varieties for subsequent consideration. Trees of one year's growth from the bud are to be preferred for the following reasons: (1) Fewer roots need be injured or lost in the process of lifting and replanting, for which reason the tree may be expected the more promptly to recover from the shock of removal. (2) The single season's growth may be cut back and the top commenced to suit the preferences of the planter. (3) The top will present little or no obstacle to the force of the wind until the roots shall have gained such hold upon the soil that there will remain little liability to displacement from this cause. (4) The risk of failure from removal is greatly diminished, while the more prompt recovery and increased rate of growth of the trees in the more open orchard rows may be expected to fully compensate for one or two years more of growth in crowded nursery rows. (5) Something will also be saved in the cost of the trees and in the expense of transportation, as well as in the labor of planting.

If older or high-branched trees are not objected to, it will usually be found that they are but imperfectly branched from having been grown in crowded rows.

9. *Preparation of the Soil.*—When the late Dr. John A. Warder was asked how large the holes should be dug for planting orchard trees, he replied, "Of the full size of the orchard;" and it may also be remarked that when the ground for an orchard has been well tilled and fertilized to a depth at least equal to that at which trees are to be planted, there is no longer occasion for holes larger than shall be necessary to receive the roots in their proper position. If the subsoil be not freely pervious to water the ground must be deeply and thoroughly underdrained, and in no case should the hole in which a tree is to be planted be sunk into a subsoil so impervious as to retain water beneath or about its roots. If such retentive subsoil occurs too near the surface, and is not considered suitable to be mixed with the surface soil, it should be thoroughly disintegrated to the requisite depth by means of a subsoil plow or other equivalent device. In all nearly level, retentive soils, it will be found advantageous to "back-furrow" a land along the line of each row in the direction of the surface drainage, so that when the trees have been planted the drainage will be away from them.

10. *Laying Out, Staking and Planting.*—The most economical mode of laying out and planting an orchard, so far as space is concerned, is doubtless that commonly, but erroneously, designated as quincunx, and more correctly as hexagonal; but whether planted thus, or in rectangles, the work may be most rapidly and accurately done by planting a stake where each tree is to stand, and using what is known as a planting board, consisting of a strip of board 6 or 7 feet long, with a hole for a stake near each end, and a notch or slot intermediate and in line between them to receive the stake, and to support the tree while the earth is being carefully filled in, under, among and above its roots.



1688. Anjou, one of the popular late fall and early winter Pears (× ½). (See page 1243.)

The following are good general rules to be observed in the digging, handling, preparing and planting of trees:

1st. In digging trees aim to secure as many of the main fibrous roots as possible.

2d. Expose the roots as little as possible to the drying influence of sun and wind.

3d. Prepare the roots for planting by cutting away the bruised and broken portions.

4th. If the roots have been essentially shortened in lifting, cut away the superfluous branches and also cut back such as are to remain till a proper balance of root and top is secured.

5th. In heavy, retentive soil, plant the tree very little if any deeper than it stood in the nursery, and, in addition, raise a slight mound about the trunk to avoid the occurrence of standing water at that point.

6th. In strong but dry soil, a tree may be planted an inch or two deeper than it stood in the nursery.

7th. In light sand, with dry subsoil, a tree should be planted 3 or even 4 inches deeper than it stood in the nursery.

8th. Dig the hole in which a tree is to be planted deep enough to receive 2 or 3 inches of fine soil, before putting the tree in place, making it large enough to allow the roots to be spread out in their natural position.

9th. See that good, friable surface soil is well filled in beneath, among and over the roots.

10th. Should the soil be dry, with no immediate prospect of rain, it will be well, after nearly filling the hole with earth, to apply a pail of water, and after it shall have settled away, to fill up the hole with earth and tramp it down firmly. Staking will rarely be found necessary, except, possibly, in the case of trees old enough to have been already branched, but such stake must be watched and the tree protected against injury by rubbing against it.

1689. Duchess Pear, the most popular variety for growing on quince roots. (See page 1243.)

11. *Subsequent Cultivation.*—(*a*) Newly planted trees: Ground occupied by young trees must be kept well cultivated during the spring and early summer. If hoed crops are planted larger quantities of manure will be required, but in either case cultivation should cease as early as the beginning of August in order to hasten the ripening of the young wood. This process should be continued during at least five or six years, after which green crops may be grown and plowed under as a means, in part, of maintaining the fertility of the soil.

(*b*) Mulching: Especially during the first few years after planting, in case of hot, dry weather during the growing season, mulch may be applied to check evaporation from the soil and to keep it cool, but it should not be permitted to take the place of cultivation. The soil should be well pulverized before applying it.

(*c*) Manuring: As stated under that head (5), manures should be applied sparingly but regularly, preferably in late autumn, and should be plowed under, or otherwise mixed with the soil at that time or in the early spring, as a means of promoting early growth and the thorough ripening of the wood in advance of severe cold. Thorough maturing of the wood should also be assisted, as already said, by ceasing cultivation the early part of August.

12. *Gathering and Ripening the Fruit.*—All selected Pears, whether intended for the market or for use at home, should be carefully hand-picked.

(*a*) Gathering summer and autumn Pears: With very few exceptions all Pears acquire a higher quality if gathered before they are fully ripe. The generally accepted rule is to gather the crop when an occasionally full grown, wormy specimen is ripe, or when there is a perceptible change in the color of the maturer specimens, or when the stem parts readily from the branch if the fruit is slightly lifted.

(*b*) Ripening summer and winter Pears: When gathered the fruit should be placed in a cool room devoted to the purpose, and spread upon shelves, or in lack of a suitable room they may be placed in shallow boxes or drawers, where in due time they will acquire their full color and flavor. Since this fruit parts with moisture quite freely, it, and especially the later ripening varieties, should be protected from a drying atmosphere, particularly from drafts of air, which will cause the fruit to shrivel and become tough and leathery. It is also true of at least very many varieties that even if blown off or gathered when but two-thirds grown, the fruit if put away as already described will usually acquire a satisfactory quality. Fruits thus gathered and ripened are found to have less tendency to decay rapidly at the core.

(*c*) Gathering and ripening of winter dessert Pears: These should remain upon the tree as long as practicable without danger from frost. When gathered, they should be placed in a cool, frost-proof room, and it will be well also to wrap each separately in soft paper. Some varieties are found to ripen perfectly without further attention, but the quality of most kinds will be much improved if they are brought into a temperature of 60° or 70° a fortnight before their usual season of maturity.

(*d*) Winter cooking Pears: These should be gathered and put away in close packages in a cool, frost-proof room, in the same manner as russet apples, like which they will shrivel, and become tough and leathery, if left exposed to the air. They may remain in this condition until needed for use.

13. *Packing and Marketing.*—In America, Pears are generally packed for market directly from the tree, without awaiting the process of ripening. Barrels are largely used as packages, although this fruit is frequently put up in half-barrels and sometimes in bushel, peck and even in half-peck baskets. American growers rarely ripen their fruit before marketing it. This, if done at all, is more generally accomplished by the dealer, doubtless with decided profit, since in the larger cities fully fifty dollars have been known to be paid for a single barrel of selected fruit, and yet the same fruit ripened and offered in quantities to suit customers has been sold at two or three times the original cost. The marketing of unripened Pears is obviously unprofitable so far as the producer is concerned.

In Europe, the choicest fruits are carefully selected and house-ripened. When approaching their best condition the fruits are separately wrapped in soft paper, and are then put up in packages of perhaps one or two dozens, and sent so as to appear upon the market when in the best possible condition. Such fruits command prices quite in excess of what they would have realized had they been offered in an immature condition.

14. *Varieties.*—Since the popular and desirable varieties of Pears may be found fully described in standard pomological works, such descriptions here are not deemed necessary. Among the very numerous varieties of Pears described in such works there are doubtless many possessing high quality and other valuable characteristics, which, for some unexplained reason, have failed to attract the attention of growers.

Since varieties vary in their season of ripening with change of latitude, and often, to some extent, with change of location, even in the same latitude, the designation of such season becomes a matter of more or less difficulty. In the following lists the season given will be approximately that between the forty-second and forty-third parallels of north latitude.

(*a*) Amateur Pears: It is as true of the Pear as of most other species of fruits, that very many varieties are of small size, unattractive appearance, or of such delicate texture when ripe as to disqualify them for the market, although they may possess, in an eminent degree, the peculiar characteristics which render them desirable, and to persons of cultivated taste, indispensable for the supply of the family. Such are termed amateur Pears.

The following is a list of a few of the most popular of these, arranged approximately in the order of maturity:

Name.	*Season.**	*Remarks.*
Madeleine	m. e. July	Earliest good Pear.
Summer Doyenne	e. July	
Bloodgood	e. July. m. Aug.	
Giffard	m. Aug.	Excellent, but very perishable.
Dearborn	m. e. Aug.	
Rostiezer	m. Aug. m. Sept.	
Manning Elizabeth	e. Aug.	
Brandywine	e. Aug. b. Sept.	

*e, early; m, middle; b, beginning.

Name.	*Season.*	*Remarks.*
Tyson	e. Aug. b. Sept.	A tardy bearer.
Stevens Genesee	b. Sept.	Rots soon at the core.
Clapp	b. m. Sept.	Rots soon at the core.
Washington	m. Sept.	
Belle Lucrative	m. e. Sept.	
Bosc	e. Sept. Oct.	
White Doyenne	e. Sept. Nov.	Liable to crack badly.
Seckel	Oct.	
Sarah	Oct.	
Anjou	Oct. Nov.	
Gray Doyenne	m. Oct. Nov.	
Reeder	Nov.	
Emile d'Heyst	Nov. Dec.	
Mount Vernon	Nov. Dec.	
Dana Hovey	Nov. Jan.	
Laugelier	Nov. Feb.	
Prince St. Germain	Nov. March.	
Lawrence	Dec.	
Winter Nelis	Dec. Jan.	[South.
Easter	Jan. March.	Succeeds best at the

(*b*) Culinary Pears: Very few dessert Pears are found to be satisfactory for culinary uses, since they too generally lose at least a portion of their flavor and aroma in the process of cooking. There are, however, several varieties of high, austere character which prove adapted to this purpose, among which are the following:

Name.	*Season.*	*Remarks.*
Vicar	Nov. Jan.	Occasionally good
Black Worcester	Nov. Feb.	[enough for dessert.
Catillac	Nov. March.	
Pound	Dec. Feb.	

(*c*) Market Pears: The markets demand varieties of attractive appearance, of at least medium size and of fine texture. To the grower, productiveness and vigor of tree are also of primary importance. If possessing the foregoing characteristics, a variety may prove at least temporarily popular, even though of comparatively low quality. The following varieties, some of which may also be found in the amateur list, are all more or less popular as market fruits:

Name.	*Season.*	*Remarks.*
Tyson	e. Aug. b. Sept.	Excellent, but a tardy bearer.
Sterling	e. Aug, m. Sept.	Productive, and exceedingly beautiful.
Clapp	b. m. Sept.	Rots soon at the core.
Bartlett	b. e. Sept.	Leading market Pear.
Souvenir du Congress.	b. e. Sept.	Sometimes very large.
Buffum	m. Sept.	Variable in quality.
Howell	m. Sept. Oct.	
Flemish Beauty	m. e. Sept.	Rots soon at the core.
Bosc	e. Sept. Oct.	Excellent for all pur-
Bousssock	e. Sept. Oct.	[poses.
Louise Bonne	e. Sept. Oct.	Grown only as a dwarf.
Onondaga	e. Sept. Nov.	
Superfin	Oct.	
Sheldon	Oct.	Is russeted and dull in
Rutter	Oct. Nov.	[color.
Anjou	Oct. Nov.	[42°.
Kieffer	Oct. Nov	Not valuable north of
Le Conte	Oct. Nov.	Succeeds best at the extreme south.
Angouleme	Oct. Nov.	Grown only on quince
Diel	Oct. Dec.	[stocks.
Clairgeau	Oct. Jan.	
Columbia	Nov. Jan	
McLaughlin	Nov. Jan.	
Lawrence	Dec.	
Josephine of Malines.	Jan. Feb.	

15. *Relative Desirableness of Dwarfs.*—There are a few varieties, among which Louise Bonne and Angouleme may be especially mentioned, which on free (Pear) stocks are either tardy bearers or require to be fruited several years before developing their ultimate qualities, but which succeed unusually well upon the quince, developing at once upon that stock their ultimate qualities. These, especially the Angouleme, are valued as market varieties when grown as dwarfs.

Angouleme, and perhaps some other varieties as dwarfs, occasionally bloom so profusely as apparently to prove unable to develop the fruit, which in consequence proves abortive. The natural and obvious remedy in such case is disbudding, or its equivalent, cutting-back the fruit-bearing shoots before growth is commenced.

The fact that very many varieties are not permanently successful when grown upon the quince is doubtless partially, if not in many cases even wholly, due to their increased tendency to early and excessive productiveness when grown upon that stock, which, owing to the very common unwillingness of the grower to remove the excess of fruit, is allowed to consume the material needed for wood growth, and thus to occasion exhaustion before the tree has gained a thorough hold upon the soil.

If, with any variety capable of forming a satisfactory union with the quince, and with the tree planted in the manner heretofore described, the entire crop of bloom or incipient fruit of the first one, two or even three years (dependent upon the vigor of the tree) were removed, and if subsequent crops were carefully and thoroughly thinned, it is at least highly probable that permanent health and longevity would prove nearly or quite as general with dwarfs as with standards, thus permitting the more extensive growth of the Pear in greater variety in small or amateur plantations and in limited grounds than is practicable with the use of standards.

T. T. Lyon.

1690. Ladders used in New Jersey for picking Pears.

(See p. 1250.)

Pears on the Northern Plains.—The culture of Pears in the middle west follows the general lines of Pear growing in the Atlantic States, but there are some radical points of difference. The difficulties of Pear growing in the upper Mississippi Valley are many and grievous. Above the fortieth parallel and west of the Great Lakes, nearly all efforts have been failures. The best successes have been on high, rather steep ridges and bluffs near watercourses, with light colored clay soils and northerly exposures. Pear trees are not planted to the bottom or to the top, but in belts midway around the slopes. Plums may be used lower down and cherries above.

The ground should be already set in clover or blue grass. Small circles are spaded out for the trees. These are cultivated with the hoe and widened with the growth of the tree. Small trees branched very low are best. The trees may be cut back the second year to within a few inches of the ground. Only a very moderate annual growth is desirable.

Use no manure until the tree has borne several crops of fruit, and then only with extreme care. Rich, black soils, plenty of manure and clean culture are deadly to Pear trees in this region.

The critical period is that of the first fruit crop. The deadly enemy is blight, which is sure to appear then. The successful Pear grower must not neglect his orchard a single day during the season of blight, but watch for the enemy and cut out and burn every blighted twig as soon as seen. Sultry, damp weather in June is most critical.

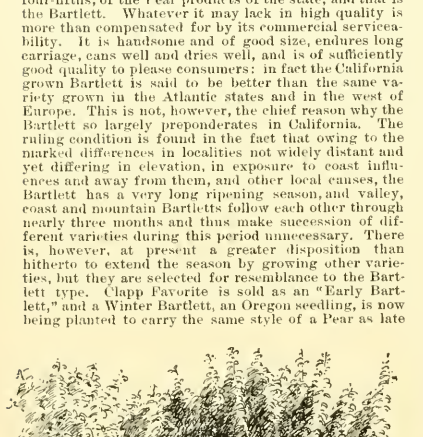
Such varieties as Warner, Longworth, Vermont Beauty, Koonee, Kieffer, etc., are said to succeed further north and resist blight better than any others. Under slightly more favorable conditions, Clairgeau, Howell, Seckel, Tyson, Washington, Flemish Beauty, etc., may be used.

The hardiest and blight-resistant varieties may be grown and when in bearing a branch or two grafted with a more delicate sort with success.

C. L. Watrous.

THE PEAR IN CALIFORNIA.—Visitors at the old California missions during the early part of the century noted the presence of seedling Pear trees in the mission gardens. Many of these trees survived the neglect which came upon the mission properties after the secularization, and were in thrifty growth and bearing at the time of the American occupation. The first Pears sold in San Francisco and in the mines in 1849-50 were gathered from old mission trees, and some of these old trees grafted over, gave the first California product of the popular European and American varieties of half a century ago. From this beginning the growth of Pears increased until the commercial product of 1899 included the following: 1684 carloads sent overland to eastern and foreign markets (about the same as for the five years preceding); 5,760,000 lbs. dried Pears shipped to the same destination (a million pounds less than the preceding year); 483,384 cases of canned Bartletts and 24,772 cases of other Pears canned, which was 140,000 cases more than the preceding year. There are about one and one-half million Pear trees in California orchards.

It is a most interesting fact that a single variety furnishes a very great part, perhaps even as much as four-fifths, of the Pear products of the state, and that is the Bartlett. Whatever it may lack in high quality is more than compensated for by its commercial serviceability. It is handsome and of good size, endures long carriage, cans well and dries well, and is of sufficiently good quality to please consumers: in fact the California grown Bartlett is said to be better than the same variety grown in the Atlantic states and in the west of Europe. This is not, however, the chief reason why the Bartlett so largely preponderates in California. The ruling condition is found in the fact that owing to the marked differences in localities not widely distant and yet differing in elevation, in exposure to coast influences and away from them, and other local causes, the Bartlett has a very long ripening season, and valley, coast and mountain Bartletts follow each other through nearly three months and thus make succession of different varieties during this period unnecessary. There is, however, at present a greater disposition than hitherto to extend the season by growing other varieties, but they are selected for resemblance to the Bartlett type. Clapp Favorite is sold as an "Early Bartlett," and a Winter Bartlett, an Oregon seedling, is now being planted to carry the same style of a Pear as late



1691. Dwarf Pear trees 45 years old, in the Yeomans orchard.

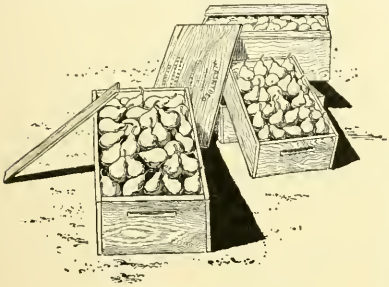
as possible. Still some progress is being made in extending the California list of popular Pears and some of local and of distant origin will probably achieve prominence, especially in the shipments to distant markets.

California Pears are grown on Pear-seedling roots—very little recourse being had to rooted cuttings or to dwarfing stocks. A dwarf Pear tree is almost a curiosity. The heavier loams and even clays are sometimes planted with Pear trees, not because they are best for Pears but because other fruits do worse than they. To fully plant the area intended for fruit, Pears will go on the intrusions of heavy or too moist soils, while the freer soil will be given to other fruits. Still the chief product of Pears is from the best loams California affords, and the profits from the tree warrant the use of such land. Pear trees are regularly pruned to a low vase form, but seldom opened in the center, the interior being used for bearing wood, and foliage enough retained to partially shade the fruit. The fruit is thinned to favor size and to relieve the tree from overbearing. Irrigation is employed in some parts of the state. The varieties chiefly grown are the following: Bartlett, Anjou, Clairgeau, Clapp, Comice, Dana Hovey, Easter, Hardy, P. Barry (a California seedling), Seckel, and Winter Nelis. E. J. WICKSON.

THE KIEFFER PEAR was grown from seed of the Chinese Sand Pear, probably crossed with the Bartlett, by Peter Kieffer, a horticulturist, who lived near Philadelphia. He first exhibited the fruit at the Centennial Exhibition, in 1876, in that city. See p. 1242. The planting of orchards of this valuable Pear began soon after this time and has continued ever since, more largely in the past 2 or 3 years than ever before. The Kieffer being wonderfully productive, the planting having gone on apace, and none of the earlier planted orchards having ceased to exist, the question may properly arise, with the great probable increase in the production of the fruit, What of the markets?

We in the East have been shipping Kieffer Pears by car-loads, sometimes packed in barrels, at other times loose or in bulk to be packed at destination, to cities in the middle West, but those cities in the future will be largely supplied with fruit grown near by. This Pear has grown in favor with consumers, to an extent fully equal to the increased production. It was observed in the Philadelphia and New York retail markets and fruit stands that during the months of October and November, in 1898 and 1899, there were very few Pears offered, except the Kieffer. It is excellent for canning and preserving, and it is fortunate that such is the case, so that a large part of future crops may be used in this manner. The Kieffer will flourish on almost any ordinary farm land, but sandy loam is preferred with gravel or clay subsoil, and prefer planting, what would generally be considered close, 150 to 200 trees per acre, leaving a driveway of 22 to 24 feet every 3 or 5 rows, on which to cart the fruit from the orchard. By close planting the trees protect each other from the winds to a great extent. Two-year trees are best for planting; let them head low, 2 or 3 feet, cut back at planting and annually for several years one-half of preceding year's growth, and keep top thinned so it will not be too dense. In this way one will have a sturdy tree that will carry two or more barrels of fruit in such shape that the orchard can be cultivated until the Pears are of marketable size. In the season of 1899 a yield of over 16,000 barrels of Kieffers was had from 80 acres of land, and now, on August 30, 1900, there is a prospect of a similar yield. An 8-foot Clark entaway, drawn by 4 mules, is still running in the orchard. In our first orchard planting of the Kieffer we were not advised of the importance of pollination, and planted large blocks without mixing in other sorts; the results were very little fruit, except on trees near to or adjoining orchards of other varieties; there Kieffer trees produced uniformly good crops. It was a heavy loss to have an orchard in this shape for several years; the remedy seemed to be, and was, to top-graft some of the Kieffer, and also to replant to other sorts blossoming at the same time. A mixture of not less than one-tenth of Le Conte or Garber answered the purpose. One to 3 per cent of the orchard trees die annually from a sort of body blight; the spaces are reset with other trees, which bear fruit in a few years. In picking the fruit we use ladders hung on wheels (old carriage wheels), which are readily handled and safe. Ladders 12 to 24 or even 30 feet can be used, but with one of 18 feet, properly hung, a man can pick Pears from the top limbs 20 feet high and the ladder need not touch the tree. Fig. 1690. The orchard can be gone over quickly and the high Pears picked first, these being most likely to be blown off and to be bruised in falling. We use, in handling

our fruit from the orchard, baskets holding ⅝ bushel, and cart into packing house on low wagons, the platform of which is made of 2-inch hemlock plank 18 feet long and hung as low as will permit a 2-foot frout wheel to turn under; being low it is very convenient to load from the ground. A man can readily load 70 to 80 baskets without getting on the wagon. and the packing house floor is about the same height as the low wagon for convenience of unloading and reloading on other wagons for carting to markets. JOHN S. COLLINS.



1692. Packing Pears for export.

DWARF PEARS.—Dwarf Pear trees are produced by budding the Pear-wood upon the French quince. The point of union should be so low that, when the young trees are transplanted into the orchard, this point will be 3 or 4 inches below the snrface of the ground. The quince, being naturally of a slower growth than the Pear, will, by the moisture of the ground and its protection from the drying effects of the atmosphere, be kept more nearly equal to the size of the Pear. As the tree becomes older the Pear will throw out Pear roots at the union, which will give increased vigor and strength to the tree in its years of maturity when producing heavy crops of fruit.

The soil best adapted to dwarf Pears is a rich loam, with a subsoil which requires thorough underdraining—a tile drain within 5 feet of every tree in the orchard would be thorough draining. The soil should be good strong corn or potato ground, and kept in such condition of fertility from year to year, for which pnrpose good, well composted, barnyard manure has no equal, but may be supplemented by other fertilizers—as ground bone and potash. Small crops, as beans and potatoes, may be grown between the trees the first few years after planting, but never should they be allowed in the least to interfere with thorough tillage, or to rob the trees of proper and desirable nourishment. The growth of the tree is of far greater value than any farm crops which can be grown between the trees. The soil should be thoroughly cultivated at least every 10 to 15 days during the growing season till about August 15 to September 1. It should cease in time that the wood may fully ripen. Suitable cultivation can hardly be given with any crop on the ground, except, possibly, when sufficient space is left without a crop next to the trees.

The trees should be planted in rows 15 feet each way, or in rows 20 feet apart each way with one tree in the center of each square. As the trees become older the entire ground should be given up to frequent cultivation, and under no conditions should a dwarf Pear orchard be seeded to grass, unless to clover for the purpose of plowing it under for fertilization.

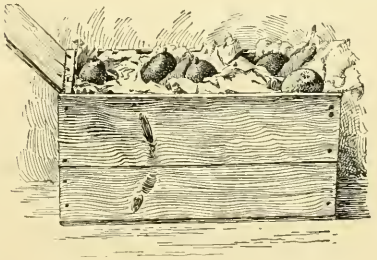
Dwarf Pears require thorough annual pruning, which may be done at any convenient time after the falling of the foliage and before the buds become in the least swollen in the spring; but where the cold is severe it is better not to prune till about the first to middle of March. This pruning should begin with the first year, and be continued annually during the life of the tree, cutting back all of the new growth to within 4 to 8 huds, and thinning out all surplus branches which will not be wanted for limbs to the tree, so that at maturity the tree shall be open-headed, with opportunity for plenty of air and sunshine all through the tree, without which superior quality of fruit cannot be grown. The lower limbs should be within 20 to 24 inches of the ground. Trees when 20 to 50 years old should not be more than 12 to 14 feet high, and the diameter of the branches about 12 to 16 feet. See Fig. 1691. It is a very erroneous impression that a dwarf Pear orchard under proper conditions is short lived. There are in the United States orchards in vigorous condition, and now producing annual crops, that are from thirty to fifty years old.

Some of the advantages of dwarf over standard Pears are: more trees can be planted to the acre, they commence bearing much younger, the fruit is not so liable to be blown off by early winds before maturity, it is much more quickly and easily gathered than from high trees, the fruit is larger and of better quality than that on standards. All varieties do not succeed equally well as dwarfs, because they do not all form an equally perfect union with the quince. Duchess is the leading and most profitable variety now grown as dwarf, although many others succeed well. L. T. YEOMANS.

PEARS FOR EXPORT.—Pears have not been grown for the export trade to any large extent, but there is no good reason for it. As France supplies the English market with the finest Pears that are grown, the American shipper needs to study the varieties, season, and extent of the French supplies to avoid a difficult competition which has to be met in seasons of full production. When the Pear crop has been light on the continent, as often occurs, we have successfully exported the Louise Bonne, Anjou, Bosc, and Winter Nelis. Later varieties, as the Easter and Josephine de Malines, with their very fine quality, would meet with ready sale in foreign markets.

As size and quality are important factors with English buyers, Pears for export should be grown upon dwarf trees, that close pruning may be done, the fruit judiciously thinned, and the much higher culture given that the dwarf tree requires.

The fruit should be gathered when it has reached its most perfect development, but not allowed to come to its full maturity, or approximate ripening. This is the right condition of fruit when it is to be shipped without refrigeration. With refrigeration, a little fuller maturity may be allowed. Each specimen should be wrapped in paper. A layer of excelsior should be placed on the bottom of the box, which is marked to be opened; over this place a sheet of paper. Pack the Pears in single layers,



1693. Box of fancy Pears for the domestic market, each Pear wrapped in paper.

covering each with paper and excelsior until the box is filled, nailing cover securely under considerable pressure. Boxes should hold 36 large Pears, and 60 of medium size. Fig. 1692. This is a refinement of even the best packing for the common domestic trade. Fig. 1693. The risk in exporting is in the lack of proper facilities on steamers that are not fitted with refrigeration. The fruit often becomes overheated and decays

in passage. Another cause for loss is rough handling. In unloading, the boxes are slid on planks, and if they are not removed promptly at the bottom of the gangway, one box strikes heavily against the side of another, bruises the fruit and its sale is injured. The best efforts and work of an entire season may be sacrificed at this point. When the fruit arrives, and opens in perfect condition, the prices received are usually 40 per cent greater than those of the home market. The best results are obtained when the Pears are packed and shipped direct from the orchard.

With fruit of superior quality, better steamer facilities, and more careful handling, a large quantity of American Pears can be exported, for foreign markets are steadily demanding and receiving increased supplies.

GEORGE T. POWELL.

PEAR. Alligator P., *Persea gratissima*. **Avocado P.**, *Persea gratissima*. **Balsam P.**, *Momordica Charantia*. **Garlic P.**, *Crateva gynandra*. **Prickly P.**, *Opuntia*.

PEARL BUSH, *Exochorda grandiflora*. **Pearl Fruit**, *Margyricarpus setosus*. **Pearl Weed** or **Pearl Wort**, *Sagina*.

PEAT is a kind of soil formed by the partial decay of plants in the swamps of the temperate zone. It is a standard potting material in greenhouse work for certain classes of plants, as ferns, orchids, heaths, rhododendrons and other ericaceous plants, woody plants from Australia and the Cape of Good Hope, and many other choice and difficult subjects. American gardeners complain that they are handicapped in growing such plants because American Peat is poorer than European, the lack of fiber being chiefly deplored.

The Peat bogs of England are often 5 or 6 feet deep, and some of the Irish ones are said to be as deep as 40 feet. They have been forming ever since the glacial period, but are now on the decline, owing largely to natural causes. Peat bogs represent the decay of many kinds of aquatic and marsh plants, but chiefly sphagnum (which see). This moss grows upward and decays below. Near the top the Peat is brown, fibrous, light and porous: lower down it tends to be black, heavy, dense and without indication of its vegetable origin. The ash varies from 1 or 2 per cent in newly formed Peat to 10, 20, or even 30 per cent in the older Peat. Peat is commonly used for fuel by the Irish peasantry, but almost never in America. In greenhouse work Peat is valued more for its porous, moisture-holding properties than for its plant-food. If dried, it may be used as an absorbent for liquid manure, "not so much for its inherent value," says Roberts (in his "Fertility of the Land"), "as for conserving the nitrogen in the manure, and for improving the condition of the stables."

The transformation of Peat bogs into arable land is rarely a pressing problem in America. It is usually too costly for a new country. The notion, however, is very common that Peat lands are extraordinarily rich in plant-food. Nevertheless, according to Roberts, swamp muck and Peat are not richer in plant-food than the good soils, with the exception of the nitrogen in the Peat, which, without doubt, is far less available than it is in good soils. (American Peat contains about .67 per cent nitrogen, .21 per cent phosphoric acid, and .13 per cent potash.) Peat lands differ from good, arable soil in being cold, sour, and too wet. To reclaim them one must drain off the superfluous water and apply lime freely to destroy the harmful organic acids. Sometimes sand or clay may be added to improve the texture. Tillage opens the soil to air, warms it, makes it uncongenial for nitrites, and congenial for nitrates. It takes time to reclaim Peat lands. Thoroughly decayed Peat is muck.

W. M.

Peat is chiefly composed of vegetable matter in what might be termed a state of suspended or partial decay. The soil which covers the greater portion of the earth's surface has been made by the disintegration of rocks and stones, through the agency of frost, water, and the atmosphere, and is composed mostly of sand and clay, these differing in proportions according to locality. Such soils are spoken of as inorganic soils, since they contain but a small percentage of organic or vegetable matter. Peat, on the other hand, is spoken of as an organic soil, since it is composed largely of vegetable matter, often as much as 97 per cent. It is formed either in the presence of water or peculiar climatic conditions. That which has been formed under the influence of water is found in swamps or the places from which water cannot pass away readily. Aquatic plants and mosses flourish, and at the end of the growing season they die down; vegetation is renewed the following season, and so on until the layers of decaying vegetation rise above the surface of the water, when ferns and plants of a more ligneous character generally establish themselves and give firmness to the surface.

That which is dominated by climatic conditions, as on the silicious sands of some parts of England, and on the heathy sands in the north of Germany, is composed principally of the roots of heaths, mosses, and other cryptogams which grew among the heaths. It forms a stratum of what might be spoken of as a very fibrous and elastic turf, usually not more than 3 or 4 inches in thickness. This Peat is not often found in this country; at least the writer presumes not, as he has not seen it offered in commercial catalogues which offer orchid supplies, though they offer fern-root, bog Peat, and occasionally, "imported Peat for orchids." The fiber is very fine and uniform, and is the ideal material for orchids, anthuriums and other tropical subjects with roots of a more or less aërial character, as it may be broken into small nodules of fiber which do not decay readily with the abundance of water and humid conditions that such plants must have at certain seasons. From its porous nature, the surplus water not only passes off readily, but there is also free entrance of air, which is as essential as water for the supply of oxygen to the roots; and by the admission of air, the material is kept in good physical condition. For these reasons, also, it is the ideal material in which to grow ericas, epacris, and other genera of the family Ericaceæ, though owing to the hot summers of this country these last-named plants cannot be grown to the perfection which they attain in England. Peat which is found in swamps is abundant in this country. It differs from the European product in not having the necessary fiber. Though not of much use for orchids, anthuriums, etc., it is useful in potting ferns, and in preparing beds for planting rhododendrons, kalmias, and other larger-growing plants of the Ericaceæ. It is also useful in mixing soils for vases which have to stand in exposed positions outdoors during the summer, since it is more retentive of moisture than ordinary soil. As a substitute for the European Peat in orchid culture, etc., American gardeners use kalmia-root and fern-root, especially the latter, which may generally be found in quantity upon the surface of the Peat which has risen above the water. When choice can be had the roots of the more slender-growing ferns are preferable to the larger and stronger-growing species, since the roots are correspondingly finer.

EDWARD J. CANNING.

PEA-TREE. *Caragana*; also *Sesbanea*.

PECAN (*Hicòria Pecán*, Britt. *Càrya olivæformis*, Nutt.). Of the 10 or more species of hickory, the Pecan is the most important from the horticultural standpoint. Possessing, as it does, the desirable qualities of rapid growth, reasonable precocity and productiveness, and producing a nut with thin shell, good cracking quality, full kernel and delicate flavor, it may well rank first among our native nuts in value and cultural importance. Its probable cultural value has long been recognized, but only within the last twenty-five or thirty years has there been systematic planting of the trees in orchard form with a view to deriving profit from the sale of the crops of nuts. By far the larger part of the commercial product of Pecans is still obtained from the wild trees of Texas, Louisiana and Mississippi.

The species is indigenous on lowlands and river bottoms throughout most of the valley of the Mississippi and its larger tributaries. It is found as far north as Davenport, Iowa, in the main valley, Covington, Ky., in that of the Ohio, and Terre Haute, Ind., in that of the

Wabash. It is also abundant throughout eastern and central Texas, extending southward into Mexico, but nowhere reaching the immediate coast of the Gulf. The area of natural distribution, therefore, covers considerable portions of Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, Oklahoma, Indian Territory, Arkansas, Kentucky, Tennessee, Alabama, Mississippi, Louisiana and Texas. Commercial plantations of considerable size have been made in most of these states, and outside of this area in North and South Carolina, Georgia, Florida, New Mexico, California and Oregon. Small experimental plantings have been made in most of the middle and northern states. The cultural era of the Pecan may, therefore, be considered as now fairly entered upon.

Under favorable conditions of soil within its natural range, the tree attains majestic, dome-like proportions, reaching a trunk diameter of 4 to 6 ft., with a height of 100 to 175 ft. and a spread of top of 60 to 70 ft. Some of the largest trees recorded are found in Illinois and Indiana in the valley of the Wabash river, near the northern limit of its natural distribution. This tendency to attain great size under favorable conditions gives rise to puzzling questions regarding the proper distance for planting in orchard form to insure the health, vigor and productiveness of the trees as they approach maturity. It has also given rise to much speculation as to the possibility of dwarfing the tree by propagating upon other species and thus, by reducing the size of top and trunk, to render the tree more tractable and if possible increase its proportional productiveness. Little careful and systematic work has been done on this line, however, most of the planted orchards still consisting of seedling trees.

Commercial Importance of the Pecan.—The importance of the Pecan as an article of commerce seems not to have been generally recognized until after the civil war. As in the case of the Florida orange, the favor which it met with from the soldiers of the Union army doubtless did much to spread its reputation in northern cities, and to pave the way for a favorable reception when first shipped in large quantities, during the period of 1870 to 1880. Since then the increase in demand has been rapid and steady, and for many years the large, thin-shelled varieties have retailed at higher prices than are obtained for any other American-grown nut. Choice Pecans of large size rarely retail in northern cities at less than 40 cents per pound and frequently rise to 75 cents for a fancy article.

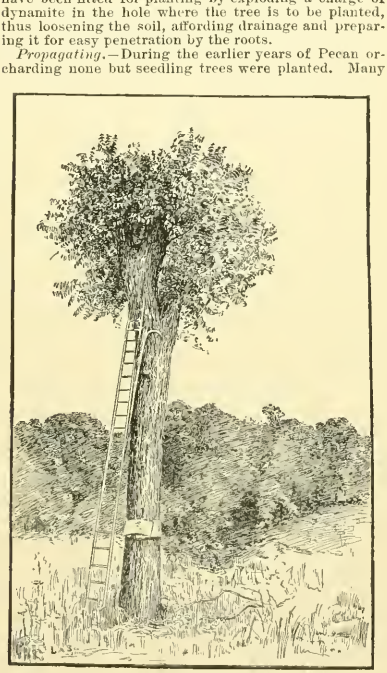
Accurate statistical data on the total yield and value of the crop are lacking, but the yield often runs into the millions of pounds per annum, single firms in Texas having handled upwards of 500,000 lbs. in a season. A large and growing demand for Pecan meats has developed among confectioners, one New York dealer having prepared and marketed 100,000 lbs. of these in a year.

From the favor with which exhibits of this nut in the American section at the Paris Exposition of 1900 were received, it seems probable that a considerable export trade can be developed whenever the supply of choice nuts exceeds the demand for domestic consumption.

Climatic and Soil Requirements.—From its wide area of natural distribution, covering, as it does, more than fifteen degrees of latitude, the species may be expected to thrive in most of the regions adapted to the culture of the common tree fruits of the north temperate zone. Trees from different latitudes are found to vary greatly in hardiness, as would be expected. Seedlings from the lower Mississippi valley succumb to the winters of Massachusetts and Michigan, when trees grown from Indiana, Illinois and Iowa seed survive uninjured. On account of lack of productiveness and the small size of nuts in the North, the area of probable profitable planting east of the Rocky mountains is not likely to extend north of the Potomac and Ohio rivers. In portions of California and Oregon the trees are reported to make a strong and thrifty growth, but there is general complaint there of lack of productiveness. Within the area in which the species succeeds, most of the profitable trees at this time are on moist and relatively fertile soil.

The moist, clayey and sandy loams of river bottoms subject to occasional overflow, are peculiarly adapted to this tree. It thrives on fertile uplands that are sufficiently moist and rich, and even on light, sandy soils when well fertilized, but the cost of the fertilizing necessary on light soils is probably too great to leave a possible profit in the culture of the Pecan. In Texas, certain soils underlaid with hard-pan are reported to have been fitted for planting by exploding a charge of dynamite in the hole where the tree is to be planted, thus loosening the soil, affording drainage and preparing it for easy penetration by the roots.

Propagating.—During the earlier years of Pecan orcharding none but seedling trees were planted. Many



1694. Top-grafted Pecan.
Four years after the operation. (Page 1254.)

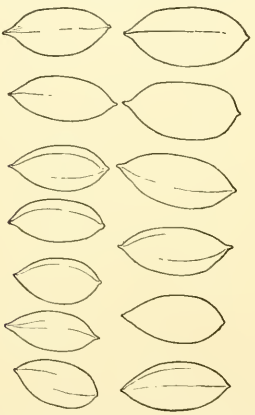
of the planters believed (as some still contend) that the seedlings would come true to type and that efforts to perpetuate valuable varieties by budding or grafting were unnecessary. As larger numbers of trees of known parentage have come into bearing it has become evident that the variation among seedlings of this species is very great and that a large proportion of the seedlings of choice varieties fail to equal the parent in vigor and productiveness of tree or size and quality of fruit. Fig. 1695 shows an instance of such variation, the thirteen forms illustrated having been produced by thirteen different seedling trees grown from one crop of nuts from a single isolated tree, by B. M. Young, Morgan City, La. Mr. Young states further that other seedlings from the same tree showed even greater variation, and that with few exceptions the nuts of the seedlings were smaller than those of the parent tree. These seedlings show little variation in vigor of growth, but vary as greatly in productiveness as in size of nut, the largest crop yet borne by the least productive consisting of less than five pounds of nuts, while the most productive has for two years borne upwards of one hundred and fifty pounds of nuts.

The early attempts to propagate the Pecan by the methods of budding and grafting practiced on the more

common orchard trees were rarely successful, and the opinion became prevalent that this species could not be budded or grafted. Various devices for propagating by layers, by upturned roots and root-cuttings were suggested and tested at different times, but none of these proved of permanent value.

The first really successful work in graft-propagation seems to have been by crown-grafting on Pecan stocks. This is most commonly practiced in early spring on stocks in place, having a crown diameter of from ¾ inch to 2 or 3 inches. The stock should be cut off smoothly at the crown and grafted either by splice, or side-cleft graft, according to size of stock. Cions with terminal buds are preferable, and they should in all cases be so cut that but one scarf exposes the pith. In this method no wax is used, but the grafted stump is carefully mounded up with moist earth to the top bud of the cion, to prevent drying out. In the humid and mild climate of the Gulf states, this is probably the most promising method for the inexperienced amateur. Bench-splice root-grafting on 6-inch top sections of one-year-old seedlings has been fairly successful in some cases, but grafts set on lower sections of root are not considered worthy of planting out. Annular budding on the new wood of second-year seedlings yields a considerable proportion of success when favorable climatic conditions prevail, but in unfavorable seasons, as of extreme drought or heavy rainfall, it results in almost total failure even with expert operators.

Top-working of the Pecan is generally difficult, only a small percentage of success usually being obtained



1695. Outlines, showing variation in the Pecan (×½). All grown from nuts from one tree.

with any method. On young trees of Pecan, Water Hickory (*H. aquatica*) or Mocker nut (*H. alba*), not exceeding one inch in diameter, occasional success by splice-grafting is obtained in Florida. Diagonal side-grafting on various hickory stocks is also occasionally successful in Florida, but no orchards of commercial importance have as yet resulted from any of these methods of propagation.

The most promising results in the top-working of Pecan trees that have yet been obtained are probably those of E. E. Risien, San Saba, Texas, who finds annular budding in June or July of strong shoots of the growth of the current season the best method. An abundant crop of such shoots is secured by cutting back the trees severely in March, using a cross-cut saw if necessary, as is sometimes the case on large trees. If the tree is old and the bark hard, the pushing of buds is stimulated by hacking the bark of the stubbed trunk and branches with a hatchet. The budding is done when the shoots attain the size of an ordinary lead pencil. Budding done on dry days is found to yield much the best results, especially if followed by several days of dry weather. The cions must be thoroughly protected against drying out between removal from the tree and budding, however; and the "tying in," for which strips of old cotton cloth are used in preference to stronger material, must be thoroughly done, to insure success. When all conditions are favorable, thrifty seedling trees are quickly transformed to choice varieties in this way, and begin to bear good crops within three or four years after the operation is performed. Fig. 1694 shows such a tree during the fourth season after budding. The tin guards about the trunks are found necessary in that section to protect both young nuts and tender shoots from destruction by squirrels during the summer.

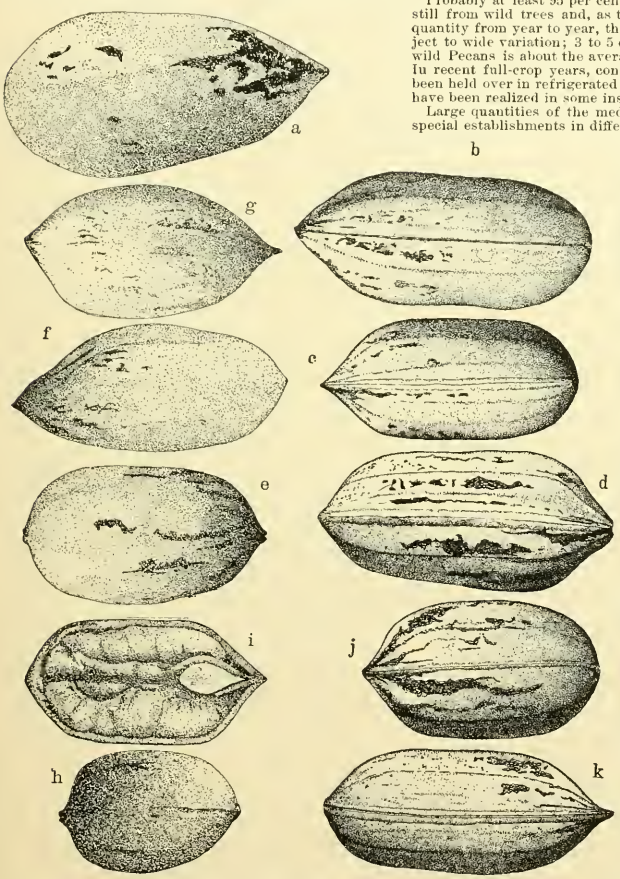
Distance, Method of Planting, and Cultivation.—From its large size it is clear that the Pecan should not be crowded. Most of the orchards planted have been at distances of 40 or 50 feet, but experience would indicate that 60 feet is a safer distance. Where seedling trees are depended upon it is probably advisable to plant closer together on the start, with a view to cutting out the trees bearing inferior nuts as soon as their true character is discovered. As at least half of the seedlings of any given lot may be expected to yield nuts very much inferior in size to the seed planted, it is probably wise to plant about double the number that are desired as permanent trees. The subsequent thinning out will leave the trees irregularly placed, but until bud propagation of the species, both in nursery and orchard, is better understood and more successfully done than at present this is probably the safest and most economical method for the orchard planter to adopt. In the earlier days many planters advocated and practiced planting the nuts where the trees were to remain in the orchard, usually planting two or three in a place to insure a "stand." The difficulty of protecting the young trees from injury and the consequent uneven character of the orchards have caused most of the later plantings to be made from the nursery row at the age of one or two years. If planted on strong and well-prepared soil to insure a vigorous growth the first season after removal to the orchard, one-year-old trees are probably preferable. The tap-root of the one-year-old Pecan tree is usually two or three times as long as the top, and more care in digging from the nursery rows is necessary than with most trees. No harm will result from a moderate shortening-in of the tap-root, however. In fact, the tree is probably benefited by the more spreading root system that results from this practice.

If the nuts are to be planted either in nursery row or orchard they should, if of valuable varieties, be stratified in sand during the winter and planted out as early in spring as the ground can be worked. If of common sorts or in regions where mice and squirrels do not abound, they may safely be planted in well-drained soil before winter sets in. Ordinary nursery cultivation will usually suffice, but nothing necessary to insure a strong and vigorous growth the first season should be left undone. Digging from nursery row is most easily done with a horse tree-digger, which cuts the roots at a sufficient depth to avoid injuring the trees.

The soil for orchard planting should be thoroughly prepared, and, if not naturally rich, should be well fertilized with well-rotted stable manure or some fertilizer rich in available nitrogen. Much depends upon securing a strong growth of both root and top the first year after transplanting. If proper care is taken to cultivate and fertilize the trees they are probably not injured by cropping with ordinary hoed crops for four or five years, especially if occasional leguminous crops, like crimson clover, cow pea or velvet bean, are plowed in. After trees reach maturity in thrifty condition, cultivation is probably less important, though some of the most productive trees reported are in fields regularly planted with cultivated crops.

Harvesting and Marketing.—The common method of harvesting is to gather the nuts at intervals of a few days as they fall, sometimes hastening the dropping by beating the bunches lightly with bamboo or other light

rods. The nuts should not be left on the ground long enough to become wet or discolored by storms, as both appearance and quality are injured thereby. Most Pecans of medium size, and below, are now polished by friction in revolving barrels before being placed with retail dealers. This process cleans and brightens the nuts, and renders them more attractive in appearance. Unfortunately, it has the same effect on stale nuts as on fresh ones, and makes possible the working off of old stock for new. Dealers have been quick to take advantage of this and frequently mix old polished nuts with new at the beginning of the season. It is therefore not advisable to polish or otherwise manipulate high-grade fresh Pecans at the present time. The demand for large, thin-shelled nuts for seed has consumed so large a proportion of the product up to the present time that market prices on large nuts for table use are hard to fix. For fresh nuts, running approximately 50 or less to the pound, the retail price is rarely below 50 cents per lb. in the large cities, while for seed, such nuts, if of well-authenticated varieties, usually bring from $1 to $2.50 per lb.



1696. Named varieties of the Pecan. Natural size.

Probably at least 95 per cent of the market supply is still from wild trees and, as the crop varies greatly in quantity from year to year, the wholesale price is subject to wide variation; 3 to 5 cents per lb. for ordinary wild Pecans is about the average price paid by buyers. In recent full-crop years, considerable quantities have been held over in refrigerated storage, and large profits have been realized in some instances in this way.

Large quantities of the medium sizes are cracked in special establishments in different cities, notably in San Antonio, Texas, and New York, and marketed in neat cardboard cartons in the form of meats ready for the domestic or commercial confectioner. Such meats usually retail at 50 to 60 cents per lb., and at a somewhat lower price their consumption will undoubtedly be largely increased.

Insect Enemies.— Among the most troublesome enemies of the Pecan are certain leaf-eating caterpillars, including the fall webworm (*Hyphantria cunea*, Drury), which is controlled by burning the webs with a torch attached to a pole as soon as it is discovered. Spraying with Paris green would doubtless be more effective in case this pest should appear in large numbers. The hickory twig-girdler (*Oncideres cingulatus*, Say) is sometimes troublesome on Pecan. The female beetle deposits her eggs in twigs which she afterwards girdles to such an extent that they are broken off by autumn winds and fall to the ground. These should be immediately gathered and burned, to prevent the larvæ from entering the ground. Certain borers, notably the painted hickory borer (*Cyllene pictus*, Drury,) and allied species, sometimes work havoc by tunneling the cambium layer and inner bark, but their attacks are believed to be confined to old or feeble trees. The hickory bark borer (*Scolytus 4-spinosus*, Say) also works upon trees that have lost their vitality through advanced age or other cause. The only known remedy for these is the prompt removal and destruction of infested trees as soon as discovered.

Probably the most serious insect enemy to the commercial Pecan-grower is the hickory-shuck worm (*Grapholitha caryana*, Fitch), the larvæ of which penetrate the hull and young nut, causing premature dropping. So far as recorded, it is less troublesome on Pecan than on the shellbark hickory (*H. laciniosa*) and its hybrids. No remedy except prompt destruction of the infested nuts by burning has been discovered.

Varieties (Fig. 1696).—Under the stimulus of the high prices paid for choice seed nuts of good reputation, many varieties of

Pecan, mostly selected wildlings, have been dignified by the application of names more or less appropriate, during the past ten years. In most instances these have been published with but brief and imperfect descriptions which do not serve to identify the varieties. As but a small proportion of them have ever been propagated by other means than by seed, the future production of nuts under these names may be expected to show great variation. The wisdom of applying varietal names to Pecans not propagated by some method of bud-propagation may well be questioned, as it is certain to result in a confused nomenclature when seedlings grown from them come into bearing. Out of more than 70 sorts that have been thus dignified with names it is very doubtful whether more than 20 have been offered by nurseries except in the form of seedlings. Of those that have been so propagated and are obtainable in southern nurseries, the following are probably the most important sorts. Little has yet been determined regarding their adaptability to other regions than those in which they originated. The price of trees ranges from 50 cents to $1.50 per tree for one- or two-year-old grafted or budded stock:

Century (Fig. 1696, *a*).—Introduced by Herbert Post, Fort Worth, Texas. One of the largest Pecans yet brought to notice, selected nuts measuring 2¼ x 3¼ inches in circumference, and running 25 to the pound.

Columbian (Fig. 1696, *b*; syns., Mammoth, Rome, Pride of the Coast).—Originated at Convent, La., and disseminated under the above names by different nurseries. Large, cylindrical, slightly constricted at middle and tapering at apex, which is frequently four-sided; shell moderately thin; of good cracking quality and delicate flavor. Tree reported to be vigorous, but irregular in bearing and yielding nuts varying greatly in size and plumpness of kernel.

Frotscher (Fig. 1696, *c*).—Originated at Olivier, La., and introduced by the late Richard Frotscher, of New Orleans. One of the largest and best in all respects. Nut cylindrical, tapering slightly; shell thin, parting easily from kernel, which with a little care can be removed entire; flavor delicate, quality excellent. Tree thrifty and productive.

Jewett (Fig. 1696, *d*).—Introduced by the late W. R. Stuart, Ocean Springs, Miss. Very large, oblong, often constricted and usually rather angular; shell of medium thickness, parting easily from kernel, which does not always fill well; quality very good.

Pabst (Fig. 1696, *e*).—Origin, Ocean Springs, Miss. Disseminated by Chas. E. Pabst, Ocean Springs, Miss. Cylindrical, moderately large; shell medium, parting well; kernel plump, bright and of excellent quality. Tree vigorous and productive.

1697. Pedicularis procera (×⅕)

Paragon (Fig. 1696, *f*).—Introduced by Herbert Post, Fort Worth, Texas. Long-obovate, with pyramidal apex, large, with moderately thin shell, cracking well; kernel plump, but with rather deep convolutions; quality very good.

Russell (Fig. 1696, *g*).—Origin, Ocean Springs, Miss. Introduced by Chas. E. Pabst, Ocean Springs, Miss. Oval, pointed, medium to large in size, with very thin shell and plump, bright kernel; cracking quality excellent; flavor delicate, quality very good. Tree productive.

San Saba (Fig. 1696, *h*).—Origin, San Saba, Texas. Introduced by E. E. Risien, San Saba, Texas. Nut cylindrical, small to medium in size, with very thin shell, fine cracking quality, very bright kernel and delicate flavor. This little nut is of the highest quality for dessert use and but for its small size would be one of the most promising yet brought to notice.

Sovereign (Fig. 1696, *i*).—Origin, San Saba, Texas. A seedling of San Saba, grown and introduced by E. E. Risien, San Saba, Texas. Cylindrical, medium to large, with very thin shell and full kernel of fine quality. A new variety of much promise.

Stuart (Fig. 1696, *j*).—Origin, Pascagoula, Miss. Introduced by the late W. R. Stuart, Ocean Springs, Miss. Cylindrical, large to very large, selected nuts running 35 to the pound; shell moderately thin, cracking quality good; kernel plump, quality good. Tree thrifty and productive.

Van Deman (Fig. 1696, *k*).—Introduced by the late W. R. Stuart, Ocean Springs, Miss. Oblong, large, running 45 to the pound; shell moderately thin, cracks well and yields plump meats of good quality.

Hybrids.—Several evident hybrids of the Pecan with other species of Hicoria have been brought to notice, the most conspicuous being the McCallister (syn., Floyd) from southern Indiana, and the Nussbaumer from southern Illinois, both evidently hybrids between *H. Pecan* and *H. laciniosa*. Neither these nor others of similar character give promise of immediate cultural value, however.

For detailed descriptions of varieties and fuller discussion of Pecan, see Rept. on Nut Culture, Div. of Pom. U. S. Dept. of Agr., pp. 49–64, Pl. 4, 8, 9, Fuller's Nut Culturist, chapter on Hickory Nuts, pp. 147–202; Rept. Mo. Bot. Garden 7, pp. 28–42, Pl. 1–23. See *Hicoria*.

Wm. A. Taylor.

PEDICULÁRIS (Latin, *louse;* long supposed to breed lice in sheep that fed on these plants). *Scrophulariàceæ.* Lousewort. About 125 species of herbs, mostly natives of the northern hemisphere, with terminal spikes of yellow, reddish purple or white fls. The few kinds cult. in hardy borders are chiefly esteemed for the beauty of their fine-cut foliage. A good many species have been tried, but they seem to be short-lived and it is conjectured that their roots are more or less parasitic on other plants. A few are annuals or biennials, but the great majority, including those described below, are perennials. They are procurable from dealers in native plants. *P. Canadensis* seems to be the only American species cult. in European gardens. A good plant of it has 6–8 fls., each ¾ in. long, in a spike 1½ in. long, which becomes 5–8 in. long in fruit.

Generic characters: lvs. alternate or whorled, rarely subopposite, 1–many times pinnately divided, rarely merely dentate: calyx anteriorly cut, variously 2–5-toothed; corolla 2-lipped, the upper one (or galea) with or without a long beak: stamens 4, didynamous: capsule ovate or lanceolate, oblique: seeds usually few.

A. *Galea (upper lip of the corolla) with a long beak (½ in. long).*

racemòsa, Dougl. Height 1 ft.: lvs. undivided, minutely and doubly crenulate: fls. white; beak circinate-incurved, nearly reaching the lower lip. Colo. to Brit. Col.

AA. *Galea with very short beak or none.*

B. *Bracts mostly longer than the fls.*

procera, Gray. Fig. 1697. Robust, 1½–4 ft. high: lvs. pinnately divided: spike 6–15 in. long: fls. sordid yellowish and greenish striate. Mts. of Colo. and New Mex.

BB. *Bracts shorter than the fls.*

C. *Capsule ovate, scarcely longer than the calyx.*

lanceolàta, Michx. Swamp Lousewort. Glabrous or nearly so, 1–3 ft. high: lvs. alternate and opposite, pinnately lobed, upper ones sessile: fls. yellow. Aug.–Oct. Swamps, Conn. to Manitoba; south, Ohio to Neb. B.B. 3:185.

CC. *Capsule lanceolate, three times as long as the calyx.*

Canadènsis, Linn. Wood Betony. The common American Lousewort, usually more or less hairy: stems

The common garden geranium, Pelargonium hortorum

commonly tufted, ½–1½ ft. high: lvs. mostly alternate, pinnately parted, all but the uppermost petioled: fls. yellow or reddish, rarely white. April–June. Dry woods and thickets, Nova Scotia to Manitoba; south, Fla. to N. Mex. B. B. 3:186. B.M. 2506. W. M.

PEDILÁNTHUS (*shoe-flower*). *Euphorbiàceæ*. Mostly small succulent shrubs, having the characters of Euphorbia, except that the involucre is irregular and enlarged into a short spur on the upper side. About 15 species in tropical America. They are easily grown with the fleshy Euphorbias in sandy loam, well drained and manured. Propagated by cutting dried at the base, then inserted in occasionally moistened sand.

tithymaloides, Poit. Bird Cactus. Jew Bush. Stem 4–6 ft. high, green: lvs. lanceolate, 1–3 in. long, dark green: involucres bright red, pointed, declined, ⅛–¾ in. long, in terminal cymes: stamen and style long exserted. West Indies. B.R. 10:837. L.B.C. 8:727 (*Euphorbia canaliculata*). B.M. 2514 (*Euphorbia carinata*).

P. macropus, Benth., with whitish stems and minute leaves, from Calif., is occasionally cultivated.

J. B. S. Norton.

PEEN-TO, or **Flat Peach** of the South is *Prunus Persica*, var. See *Peach* and *Prunus*.

PEEPUL TREE. *Ficus religiosa*.

PEIRÉSKIA. See *Pereskia*.

PELARGÒNIUM (*stork*, because the fruit is long and slender like a stork's bill). *Geraniàceæ*. Geranium of gardens. Pelargonium. The person who wishes to study the contemporaneous evolution of plants may find his heart's desire in Pelargonium. With great numbers of species and many of them variable and confusing in a wild state, with plant-breeding in many places and continued through two centuries, and with a large special literature, the genus offers exceptional advantages and perplexities to the student. Most of the species are South African, whence they early came into cultivation by the English and Dutch. *P. cucullatum*, the dominant parent in the florist's Pelargoniums, was known in England as early as 1690. The two originals of the race of zonal or bedding Geraniums were introduced into England in 1710 and 1714. Early in that century, a half dozen species were grown at Eltham, in the famous garden of James Sherard, and these were pictured in 1732 in Dillenius' account of that garden, "Hortus Elthamensis," a sumptuously illustrated work in quarto. Even at that time, *P. inquinans* had varied markedly (see Fig. 1698). In his "Species Plantarum," 1753, Linnæus described the few species which he knew (about 25) under the genus Geranium. In 1787, L'Heritier founded the genus Pelargonium, and transferred many of the Linnæan species. L'Heritier's work "Geraniologia," a quarto, appeared in Paris in 1787 to 1788, with 44 full-page plates. Early in the nineteenth century, many species were in cultivation in Europe, and experiments in hybridizing and breeding became common. There seems to have been something like a Geranium craze. The experiments seem to have been confined chiefly to the development of the show or fancy Pelargoniums, as greenhouse subjects. The Geranium interest seems to have culminated in Robert Sweet's noble work on "Geraniaceæ," published in five volumes in London, 1820 to 1830, containing 500 well-executed colored plates of geraniaceous plants. At that time many distinct garden hybrids were in cultivation, and to these Sweet gave Latin botanical names. His fifth volume is devoted chiefly to garden forms of the show Pelargonium type, to which the name *P. domesticum* is given in the following sketch. The development of the zonal or bedding Geraniums had begun in Sweet's time, and he includes

1698. Pelargonium inquinans (and a variety of it) as figured by Dillenius in 1732.
One-half size of the original plate

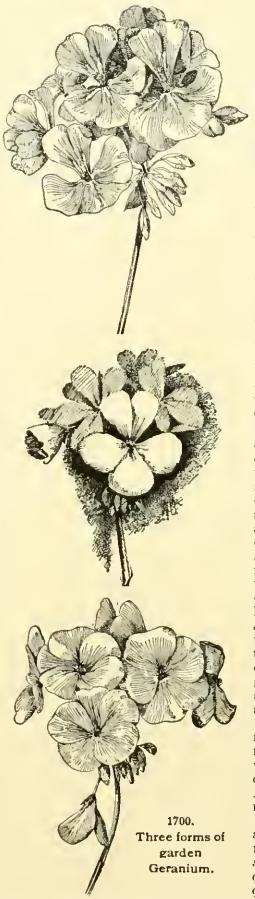
them in his pictures, but the larger part of their evolution is subsequent to his history. Various small works on Pelargonium have appeared. De Jonghe's "Traité Méthodique de la Culture du Pélargonium," Brussels, 1844, contains good bibliographical and cultural data.

Most of the cultivated forms of Pelargonium can be grouped into four general horticultural classes:

I. The zonal, horse-shoe, fish, or bedding types, known to gardeners as Geraniums. They comprise a mongrel class, lately designated (Bailey, "Botany," p. 314) as *Pelargonium hortorum*. This race seems to be derived from *P. zonale* and *P. inquinans*. These species were made by Linnæus in 1753, but he founded them on descriptions in earlier works rather than directly on the plants. In America, the zonal Geraniums are very popular, for they develop their colors well in the bright climate. They are popular in all countries, however. They probably stand closer to the lives of a great number of people than any other ornamental plant. If a window or a garden can have but one plant, that plant is likely to be a Geranium. The old race of large-flowered and large-clustered Geraniums was known as Nosegay Geraniums, because they were bouquet-like, but this term is not known in America. Another race has been developed for its zone-marked leaves. There is also a race of double-flowered zonals, which have appeared chiefly since 1860. The very full double and close-clustered forms lose much of the grace and charm of the single types. Some of them are little better, to a sensitive eye, than balls of colored tow or wadding. In the development of the individual flower of the Geranium, there have been two ideals —the English ideal for a circular flower with the petals broadened and overlapping, and the continental ideal with a somewhat 2-lipped flower and the petals well separated. In the Gardeners' Chronicle in 1841, p. 644, the proper form is set forth in an illustration, and this is contrasted with the "original form;" the picture is reproduced, somewhat smaller, in Fig. 1699. "The long, narrow, flimsy petals of the old varieties," the writing says, "moved by every breath of wind, and separated to their very base by broad, open spaces, have been succeeded by the beautiful compact flowers of the present day, with broad stout petals so entirely overlapping each other as to leave scarcely an indentation in the outline of the flower; while the coarseness which prevailed in the larger of the old sorts is replaced by a firmer substance, and a far more delicate texture." Fig. 1700 shows contrasting ideals, although the picture does not represent the extremes.

1699. Gardener's ideal, and the original form, as depicted in 1841.

In recent years a French type has appeared under the name of "gros bois," or "large-wood" race. It is characterized as follows by Dauthenay: umbels ordinarily 4–5 in. in diam.: fls. very large; petals roundish, or sometimes triangular, the limb always very large and giving the corolla a remarkably round contour: lvs. very large, thick and coriaceous, plane or incurved, more or less indented, strongly nerved, their diam. averaging about 5 in.: pedicels large and short: peduncles large, rigid, and projecting beyond the foliage: wood soft, fleshy, very large, often 1½ in. around. To this type Dauthenay refers the Bruant Geraniums, dating from 1882.



1700. Three forms of garden Geranium.

The upper two show the 2-lipped ideal. Uppermost is Mrs. E. G. Hill; middle one, Maculatum; lowest, Wistre.

A special handbook is devoted to these plants: Dauthenay, "Les Géraniums," Paris, 1897.

II. The ivy-leaved Geraniums, the products of *Pelargonium peltatum*. Fig. 1702. The species is said to have been introduced into England in 1701. It is a weak and straggling plant, used mostly in vases, hanging baskets, and other places in which an overhanging subject is desired. The foliage is thick and shiny, slightly peltate and prominently angle-lobed, and the pink or reddish 2-lipped flowers are always admired. Much-improved and double forms are now in commerce, and the plant is probably more popular than at any time in its history.

III. The show or fancy type is known to gardeners as Pelargonium, and in this country also as Lady Washington Geraniums. Fig. 1705. These plants are very popular in Europe, being grown in numerous varieties. They are prominent at the exhibitions. Because of the hot, trying summer climate, these plants are of very secondary importance in America, although there are many gardeners who succeed well with them. This race of Pelargoniums seems to have descended chiefly from *P. cucullatum*, although *P. angulosum* may be nearly equally concerned in it. *P. grandiflorum* is also thought to have been a formative parent. It is probable that two or three other species are concerned in the evolution. In fact, the late Shirley Hibbard once wrote (G.C., July 3, 1880) that "it must be evident to every cultivator of these flowers that the blood of a score or so of species is mingled in them." This marked garden race, which represents no single wild species, is designated below as *P. domesticum*.

IV. Various scented-leaved Geraniums, known mostly as Rose Geraniums. These are of several species, with their hybrids and derivatives. The common Rose Geraniums are nearest *P. graveolens* and *P. Radula*. The Nutmeg Geranium is *P. odoratissimum*.

Aside from the above groups there are several species which appear sporadically in the trade, as *P. tomentosum*, *P. echinatum*, *P. triste*, *P. quinquevulnerum*, *P. fulgidum* and *P. quercifolium* or the derivatives of each. The other species mentioned in the following account (and not mentioned above) are not known by the writer to be in the American trade, but they are of interest as parents of garden forms or for other special reasons. Many of the true species of Pelargonium are very satisfactory plants, and they deserve to be better known. Few great collections of Pelargonium species and varieties have been made in this country. The late John Saul, Washington, once had a very large collection. Robert Sandiford, Mansfield, Ohio, is a prominent grower of the zonal and ivy-leaved class; also the Cottage Gardens, Queens, N. Y.,

and E. G. Hill & Co., Richmond, Ind. John H. Sievers, San Francisco, has a large collection of the Lady Washington class. The Horticultural Department of Cornell University has had about 1,000 varieties and species, representing all groups.

Bentham and Hooker estimate that the genus Pelargonium contains about 170 species. Nearly all of them are from South Africa. All the species mentioned in this article are from that region. Harvey, in Vol. I of Harvey & Sonder's Flora Capensis (1859–60), admits 163 species; and his descriptions are followed closely in the characterizations of species given below. Pelargonium is distinguished from the genus Geranium by technical characters. In most cases, the flowers of Geranium are regular, but those of Pelargonium are irregular, the two upper petals differing from the others in size and shape and often in coloring. The most constant difference between the two genera is the presence in Pelargonium of a nectar-tube, extending from the base of one of the sepals and adherent to the side of the calyx tube or pedicel. This tube is not seen by the casual observer, but it can be discovered by making a longitudinal section of the flower and pedicel. In Pelargonium the calyx is 5-parted; petals 5, mostly obovate or spatulate, in 2 sets or series comprising 2 upper and 3 lower; stamens really 10, but 3 or more of them merely sterile filaments.

L. H. B.

Culture of Zonal Geraniums.—While the general florist may consider Geranium culture the easiest of all gardening, the fact remains that it is as necessary to observe the requirements of the Geranium as it is to observe the requirements of any other plant, in order to succeed and produce the best effects attainable. While it is true that the Geranium will grow and make a good showing with comparatively little care, there is as much difference between a skilfully grown Geranium plant and one carelessly grown as there is between a fancy and a common rose or carnation.

In order to secure the best results it is necessary to propagate from perfectly healthy stock. The dangers of over-propagation are as great with the Geranium as with most other plants. In order to keep the majority of the varieties in good health it is necessary to plant the stock intended for propagation in the field and to propagate either from the field-grown wood in August or early September, or to lift the plants in the month of September and plant them on benches in the greenhouse, where they will become established and will maintain a vigorous constitution throughout the winter season. The propagation from field-grown wood is far less successful than from wood grown inside, and when the field-grown cuttings are placed in sand, a large percentage of them is likely to damp off, especially if there has been a comparatively abundant rainfall during the month of July. The best method that the writer has found for striking the field-grown cuttings is to put them in 2-inch pots, using a light, sandy soil free from all manure and chemicals, and to place the pots in the full sunlight either in a coolhouse or a frame. These cuttings must be kept on the dry side until the calluses have been well formed, although they should not be allowed to shrivel at any time. If the cuttings show signs of shriveling, a light syringing is preferable to a heavy watering. After the roots have started to grow, the treatment of the plants is the same as if the cuttings had been rooted in the sand and repotted. The writer considers wood grown inside superior to field-grown wood, as the cuttings are much shorter-jointed; most of them can be taken from the plant with a heel and 95–100 per cent of them will root in sand in the ordinary cutting-bench.

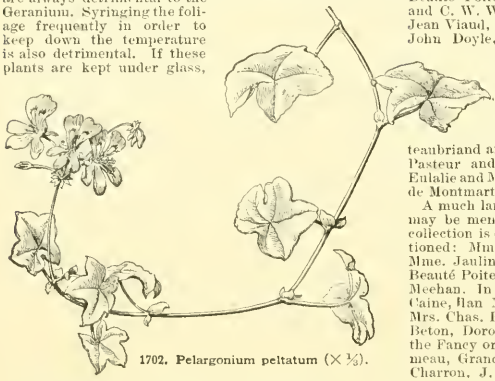
A good temperature for the Geranium propagating house is 56–60°, with a bottom heat of 65–68°. While the cuttings are in the sand and before they are rooted, care must be taken about keeping them too moist for fear of "damping off," or what Geranium growers know as "black rot." As soon as the Geranium cutting is thoroughly callused and begins to emit roots it should be potted up at once. The best soil for Geraniums, according to the writer's experience, is a firm, pliable clay loam; this is best if used absolutely without any manure, especially fresh manure. After potting the cuttings they should be lightly watered and shaded for a day or so if the sun is extremely hot, until the roots take hold and the foliage fills up and the stems begin to look plump. The Geranium should not be grown at any time in its young state in a soil that is too rich, and care must also be taken that the plants are not kept too wet.

The Geranium is subject to few diseases, and so far as the writer has been able to observe these diseases are brought on by improper treatment, such as having too much fresh rank manure in the soil or keeping the plants too wet. Too much strong plant-food in the soil combined with too much moisture produces a spotted condition of the leaves ordinarily called "spot." It usually appears in the hottest weather or immediately after extreme heat accompanied by copious showers or rains.

Excellent specimen Geranium plants may be grown in pots, especially of some of the newer French and English round-flowered varieties. In order to produce the best results, select young, vigorous plants that have been propagated either in the latter part of August or the fore part of September, and that have shown a disposition to take hold immediately, both in rooting and in starting to grow after being potted. The soil should not be too rich, and it is best to start with the plant in a rather small pot, say 2½ in., and proceed onward with light shifts,—that is, shifting the plant from a 2½-in. to a 3½-in. pot, and so on, letting the sizes increase an inch at each shift until a 7-, 8- or 9-in. pot is reached, which will usually be large enough to flower the finest specimens. Whenever potting the Geranium, be sure to pot firmly, as a firm soil produces a short-jointed, stocky growth, and far more bloom than a loose or over-rich soil. When the plants reach a 5- or 6-in. pot they may be regularly fed with manure water. The most

1701. Leaves of various fancy-leaved Geraniums—P. hortorum (×½).

critical time for these specimen Geranium plants will be during the months of July, August and September; during these periods exposure to intense sunshine should be avoided. Too much water and a close temperature are always detrimental to the Geranium. Syringing the foliage frequently in order to keep down the temperature is also detrimental. If these plants are kept under glass,



1702. Pelargonium peltatum (× ⅓).

a light shading or stripping upon the glass is beneficial. Probably the best position for such plants during these three extreme months is on the north side of a row of trees, some distance away from the trees, where the plants will have the benefit of the subdued shading of the foliage. If kept under glass and shaded, abundant ventilation should always be provided As the winter approaches, a night temperature of 60° and day temperature of 70°–75°, with plenty of ventilation during the daytime, especially in bright weather, seems to best suit the plants. Syringing ruins the flowers, and too much moisture either in the pot or upon the foliage causes the spotting of the foliage known as "dropsy." In planting the Geranium in the field or in beds always avoid an over-rich soil. The soil should be in good condition and fertile, but must not be loaded with either chemical or animal fertilizer. Too much water at any period during the hot weather produces a rank growth, reduces the quantity of bloom and in the majority of instances causes the spotted foliage to appear.

Another disease, which is sometimes serious, especially in extremely hot seasons accompanied with a superabundance of moisture, is "stem rot." This frequently attacks imported stock. Just what produces this disease the writer is unable to say, but it is most serious during intensely hot seasons; the entire plant turns black and fades and withers away. The stem rot occurs in varieties that have been very heavily propagated.

The insects that affect the Geranium are also comparatively few. The red spider is sometimes a serious pest during the summer and is difficult to get rid of when it is once well established. The only method that the undersigned has found efficacious is to syringe the plants with an extremely fine spray, and also to pick off the leaves that are seriously affected and burn them. The greenfly is also troublesome at times, but is easily managed with the ordinary fumigation of tobacco. There is a small caterpillar that eats the foliage and sometimes proves a serious pest. If one can induce a few ground sparrows or any of the warblers, or even English sparrows, to make their home in the greenhouse, they will put a speedy end to these caterpillars. Another remedy is to go over the plants carefully and pick the caterpillars off and destroy them. This is tedious, as it must be done frequently.

In the way of bedding Geraniums, as a rule the Bruant section produces the best results, but there are a number of English and French varieties that do especially well in our hot climate. The greatest difficulty that we have in successful Geranium culture in America is the intense heat of the summer months, chiefly July and August. The writer has found that the following varieties grow especially well in the field as well as in beds on lawns. In the Bruant section: Mme. Landry, Beauté Poitevine, Mme. Charotte, Mme. Chas. Molin, and C. W. Ward, all of varying shades of salmon-pink; Jean Viaud, pure clear pink; Mme. Jaulin, peach-pink; John Doyle, A. Riccard and General Grant, scarlet; Thos. Meehan, magenta-pink; Count de Castellane, a deep crimson-scarlet. Among the French varieties: Mme. Barney, Mme. Philip La Brie and Francis Perkins, pure pink; Rene Baziu, bright rosy salmon; Gertrnde Pearson and Grandville, pure pink; Marvel, S. A. Nutt, Richelieu, Chateaubriand and De La Vigne, brilliant crimson-scarlet; Pasteur and John P. Cleary, bright orange-scarlet; Eulalie and Mme. Buchner, snow white; Cæsar and Dnke de Montmart, brilliant aniline-purple.

A much larger list of varieties suitable for pot culture may be mentioned, for when growing in pots a larger collection is desirable. Among the Bruants may be mentioned: Mme. Charotte, Jean Viaud, Mme. Landry, Mme. Jaulin, Mme. Chas. Molin, Count de Castellane, Beauté Poitevine, Mme. des Bordes Valmore, and Thos. Meehan. In the English round-flowered section: Hall Caine, Ian Maclaren, Wm. Ewing, Gertrude Pearson, Mrs. Chas. Pearson, Barbara Hope, Lillian Duff, Mary Beton, Dorothy Burroughs, and Rudyard Kipling. In the Fancy or Aureole section: Andrew Lang, Jean Remeau, Grandville, La Fraicheur, Mark Twain, Hubert Charron, J. B. Varrone, Mme. Bruant, Mme. Blanche Jamet, George Sand and Daumier, crimsons and scarlets; Rasphail Improved, John P. Cleary, Richelieu, Chateaubriand, Dr. Despres, Rycroft Pride, Pasteur; in salmons, Modesty, Nydia and in purple Duc de Montmart.

C. W. Ward.

Show Pelargoniums.—What we know as show Pelargoniums have enjoyed a long popularity. By the general public, and by old people especially, they are known as Lady Washington Geraniums. They are not so commonly grown as Geraniums, chiefly on account of their limited season of bloom and the fact that they cannot endure our hot midsummer suns. Through the greater part of the summer they are liable to be neglected. They also require different treatment from Geraniums, and—if skill there be—more skill in cultivation.

1703. A good Pelargonium (× ½).
P. cordatum of botanists or an offshoot of that species.

We will commence at the end of the blooming season. They are past, and require rest,—a season of ripening the growth already made. During this time very little water will be needed, and they may be stood out in the full sun. We need only cut off the old flower-stems. In no sense should they be cut back at this time, neither should water enough be given to encourage new growth. All the leaves should stay on until they naturally turn yellow with age, thus securing a thoroughly ripened growth. In September, one may prune them into shape; sometimes rather severely, but in any case cut out all weak and soft shoots. They should then be shaken out

and repotted in a light compost, not rich, into the smallest sized pots that will hold them, for the process of growing them on has to be gone over every season. After potting, a good soaking will be necessary, and they may be placed in a well-lighted coldframe. There is no need to keep them close; the stimulation of water, and the slight protection of a frame being usually enough to start them into new growth. No forcing will ever be needed at any season, and if one wished he might keep them in a coldframe until very late in the season, so long as adequate protection against frost is afforded. With us they are at their best in late May and June, and to have them in good condition we grow them slowly in a house averaging about 50° night temperature (slightly less in midwinter), from October onward.

After the turn of the days—in January—we repot them, using now a richer compost. We give a fairly good shift, depending in part on the size of plants desired, the vigor they show, and the difference in varieties. If we had wanted them to bloom in April or, as some florists might, at Easter, we should have potted them at once—in late August or September, into the size they should bloom in,—a medium size, probably the same as they had lately occupied, and have taken them indoors to grow on continuously. But for our display, in May and June, they are potted again in January, and some may be given another shift when extra vigor or the possible need of a few extra large specimens demand it. They will need careful stopping. Some rubbing out of weak shoots, when they break abundantly, will help those that remain, and we may even have to do a little pruning. Stopping, however, must be discontinued as soon as the flowering stems begin to show, which is about the end of February in the writer's practice. These stems can be distinguished easily by a slightly different manner of growth. Up to this time the plants may be allowed to grow naturally; but if we want trained specimens we must begin to bend them as we wish them to grow, as their growth speedily hardens and the plant will readily take and keep the form to which it is shaped.

Water should be given sparingly through the dead of winter. February and March are the months when the most growth is made, and at this time we can stimulate them materially by the judicious use of artificial manures, which may, if necessary, be continued until they come into bloom. They are much subject to the attacks of greenfly and red spider; and as the foliage is fairly tender and liable to injury from tobacco smoke, we are compelled to rely upon fluid insecticides almost wholly The blooming season is very much lengthened by giving a slight degree of shade.

The best time to take cuttings is soon after the flowering season. Often towards the last of the season, the plants make a few "growing" shoots, and these we take; but off and on during the summer we can get cuttings, and any time until August will do. Cuttings taken during winter time with a heel make pretty little plants in 4- or 5-inch pots without stopping. Cuttings taken at the usual time and grown on in 6- or 7-inch pots come in handy in grouping for the front lines. It is necessary to raise a few plants every season to replace older plants which have grown too large. New varieties are raised from seed, which is freely produced. In hybridizing it does not appear that hand-pollination has any effect, as the seedlings seldom show any particular affinity to either parent.

There is a dwarf strain of show Pelargoniums known as "fancy." The plants are usually heavily blotched and very free-blooming. The writer has never seen any in this country.

T. D. HATFIELD.

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A. *Plant with thick, succulent branches, and strong fishy odor: lvs. orbicular or reniform, shallowly if at all lobed: inflorescence umbellate: good stamens 7, the 2 upper ones short.* (*Cicotium.*) FISH OR BEDDING GERANIUMS.

1. **zonàle**, Willd. ZONAL, or HORSE-SHOE GERANIUM. Shrubby in its native place and in warm countries, becoming woody at the base even in pots, the young branches somewhat hispid: lvs. round-cordate, glabrous or pubescent, long-stalked, usually with a zone or horse-shoe mark of deeper color on the upper surface, the margin crenate-dentate, with several very shallow rounded lobes: stipules broad, cordate-oblong: peduncles long, the fls. nearly sessile: calyx-tube glabrous or nearly so, 4–5 times longer than the lanceolate segments; petals separated, narrow-wedge shape or spatulate.—"Among shrubs and on hillsides. . . . The flowers vary from scarlet and crimson through all shades of red to pure white."—*Harvey.* Probably originally red. *P. zonale* was introduced into England in 1710. Linnæus described it in 1753 as *Geranium zonale*, founding the species on previous descriptions, not on specimens. It is probable that the species had been considerably modified by domestication when Linnæus wrote. There seems to be no accepted portrait of the original form of the plant.

1704. Pelargonium angulosum.
From Dillenius' figure in 1732. One-half the size of the original plate.

2. **inquinans**, Ait. FISH GERANIUM. Fig. 1698. Plant more velvety than *P. zonale*, sometimes more or less viscid, the leaves not zoned: calyx-tube densely glandular and viscid, 3–4 times longer than the lanceolate segments; petals broadly obovate, scarlet, but now varying to lighter colors.—"Among shrubs and on hillsides." This is the *Geranium inquinans* of Linnæus,

who founded the species on previous descriptions. One of the descriptions (Dillenius, in "Hortus Elthamensis," 1732) was accompanied by a picture, and this picture, reduced one-half, is reproduced in Fig. 1698. It will be seen that even in that early day the species had varied into a form with short-notched petals and short pedicels. Introduced into England in 1714.

3. **hortòrum,** Bailey. COMMON FISH or BEDDING GERANIUM. Figs. 1699-1701. The common Geranium in great numbers of forms, derived from the blending of *P. zonale* and *P. inquinans* in more than a century of careful selection. The original species are not now in cultivation. Practically all garden Geraniums have the zonal marks on the leaves or bands or a central blotch of variegation. Some of them have intermingled colors of green, white and red on the same leaf. Some are "silver-banded" and some "gold-banded." See Fig. 1701.

AA. *Plant weak and usually trailing, the branches slender and not succulent: lvs. fleshy and glossy, lobed, marginally peltate: inflorescence umbellate: good stamens 7, 2 upper shorter.* (*Dibrachya.*) IVY-LEAVED GERANIUMS.

4. **peltàtum,** Ait. (*P. scutàtum,* Sweet. *P. hederæfòlium,* Hort.). Fig. 1702. Plant with slender-jointed, more or less zigzag stems which are glabrous or very nearly so (except at the top): lvs. glabrous or minutely pubescent, fleshy, the petiole inserted just inside the margin at the base, about 5-nerved, with about 5 short wide, mostly obtuse main lobes and often with smaller minor lobes or angles and notches: peduncle very long, originally 4-8-fld., but now bearing many greatly modified fls., the calyx-tube slender and stalk-like and often longer than the pedicel and 2-3 times longer than the pointed nerved and mostly ciliate lobes, petals twice as long as calyx-lobes, red to white or purplish, the 2 upper ones erect and purple-blotched or striped, the 3 lower ones usually smaller and not marked and separated from the upper as if the flower were 2-lipped. B.M. 20. — Parent of the Ivy-Leaved Geraniums, now much improved and varied. Prized for baskets. There are forms with double fls. and colors of various kinds. It is a most desirable plant and very floriferous in most of the garden sorts.

1706. Pelargonium quercifolium (× ½).

AAA. *Plant woody, not succulent, the foliage often scented but not "fishy;" lvs. various, but not distinctly pinnately parted: inflorescence paniculate or umbellate: good stamens 7 or 6.* (*Pelargium.*)

B. *Stipules present and conspicuous.*

C. *Lvs. not distinctly lobed, though often angled, mostly oval or ovate and cordate. Exceptions in P. domesticum.*

5. **betulìnum,** Ait. Erect and shrubby, downy only on the young growths: lvs. stalked, oval or ovate, obtuse or not prominently acute, rounded or truncate at base, the stipules sharp and deciduous: fls. light purple, the broad upper petals with dark streaks. B.M. 148.—A handsome and neat plant.

6. **cordàtum,** Ait. Fig. 1703. Shrubby and erect, villous or nearly glabrous: lvs. long-stalked, cordate-acute, denticulate and sometimes obscurely lobed: peduncles usually branched, the pedicels and calyx soft-hairy: fls. purplish, the petals twice as long as the sepals. B.M. 165 (as *P. cordifolium*).—Told from *P. cucullatum* by its flat cordate-acute lvs. It is a handsome plant in bloom. The plant in cultivation as *P. cordatum* (Fig. 1703), has leaves more truncate at the base than the descriptions and old pictures call for, although on some shoots the leaves may be typically cordate.

7. **cucullàtum,** Ait. Tall and shrubby plant, much branched, softly and densely villous: lvs. long-stalked, kidney-shaped and cupped or cucullate, denticulate, very soft-pubescent, the stipules ovate-acute and withering: fls. purple, in many-fld. panicles, the pedicels and calices densely silky-hairy, the petals twice as long as the lance-acuminate sepals.—"Very common round Capetown and in the western districts, where it is often used as an ornamental hedge-plant."—*Harvey.* Known in England from 1690, and the parent, with *P. angulosum* and probably others, of the fancy or show Pelargoniums of gardeners. Not known in cult. in its pure or original form.

8. **angulòsum,** Ait. Fig. 1704. Differs from *P. cucullatum* in its harsh-hairy covering and rigid angled leaves: the lvs. are short-stalked, truncate or broadly cuneate at base, with 3-5 shallow angular and acute short lobes; panicles with fewer-fld. umbels.—Linnæus

1705. Pelargonium domesticum (× ½).

One of the Show or Lady Washington Pelargoniums.

included this plant in his *Geranium cucullatum*, but Aiton separated it as a distinct species. Linnæus' *G. cucullatum* was founded on literature. One of his sources of information was Dillenius' "Hortus Elthamensis," with a picture; but this picture, which is reduced one-half in Fig. 1704, is what is now known as *P. angulosum*. This is one of the species which has entered largely into the Pelargoniums of florists.

1707. Pelargonium Radula (above) and P. graveolens (×⅓).

9. **domésticum.** Common, Show, Fancy and Lady Washington Geraniums (or Pelargoniums). Fig. 1705. The writer proposes this name for the garden type of fancy Pelargonium. The race is said to be derived chiefly from *P. cucullatum*, *P. angulosum* and *P. grandiflorum*, but the writer can see little evidence of the blood of *P. grandiflorum*. It seems to be nearest to *P. cucullatum*, having the cucullate or disk-shaped not lobed lvs. and mostly the soft-hairiness of that species. In many of them, however, the leaves are distinctly angle-lobed, suggesting *P. angulosum*. It is a fair question whether *P. cucullatum* and *P. angulosum* are themselves to be considered specifically distinct. *P. domesticum* is meant to comprise the whole range of garden forms of the Show or Lady Washington Pelargoniums. The name will enable one to talk about these garden plants with precision. To many of these garden forms specific botanical names have been given, so that *P. domesticum* is not the first name that has been applied in this group, but the writer is not aware that any collective or group name has been given. Sweet, in particular, has given Latin names to various forms. These old names, however, apply to particular historical forms, and it would be violence to enlarge their application to cover the entire group, and it would be difficult to select any one of them as more applicable, under botanical rules, than others. It is also inaccurate to call this garden form either *P. cucullatum* or *P. angulosum*.

1708. Pelargonium denticulatum. (×⅓.)

cc. *Lvs. sharply 3-7-lobed and sharply toothed or serrate.*

10. **grandiflòrum,** Willd. Shrubby, glabrous and glaucous: lvs. long-stalked, strongly 3–7-nerved from the top of the petiole, deeply 5–7-lobed, the lobes broad and sharp-toothed, the stipules ovate and mucronate: fls. about 3 on each peduncle, the stalk-like calyx-tube 3–4 times as long as the lanceolate segments, the obovate white petals (upper 2 with red lines) 3 times as long as calyx-segments.—A handsome and distinct species, not now in cult. in its pure form.

11. **capitàtum,** Ait. Stems weak and trailing, with long white hairs, woody at the base: lvs. long-stalked, cordate, 3–5-lobed and the lobes rounded and toothed: peduncles longer than the lvs., densely many-fld., the fls. sessile, rose-purple, with calyx-tube much shorter than the hairy mucronate calyx-lobes.—Plant rose-scented, but not in general cultivation in its pure form.

ccc. *Lvs. cordate-lobed, soft and velvety.*

12. **tomentòsum,** Jacq. Plant rather thick- and soft-stemmed, long white-hairy all over: lvs. very long-stalked, very broadly cordate-ovate, 3–5–7-lobed and small-toothed, soft and velvety: stipules ovate-acuminate, withering: fls. small, white, with red near the center, in a lax panicle.—Scent like peppermint, and for that reason it is somewhat grown. The stems are long and straggly.

cccc. *Lvs. deeply several–many-lobed, with narrow divisions rather rough or stiff, strong-scented.* Rose Geraniums.

13. **quercifòlium,** Ait. Oak-leaved Geranium. Scarlet-flowering Rose Geranium. Fig. 1706. Shrubby and branchy, somewhat hairy and glandular: lvs. with stalks 2–4 in. long, cordate-ovate in outline, with 2–3 pairs of oblong side lobes (lvs. pinnatifid), which extend nearly to the midrib and are again toothed and notched: stipules small, 2 pairs at each node: fls. few–several rather small, red or purplish, in umbels and with short pedicels.—A rather common greenhouse plant, the lvs. often with a dark spot.

14. **gravèolens,** Ait. Fig. 1707. Much like the last, but lvs. longer-petioled and palmately 5–7-lobed or parted, the broad lobes flat and pinnatifid into many mostly obtuse lobes: stipules cordate-acute: fls. many on mostly long peduncles, pink or light purple, small, the calyx hairy and nearly sessile, the calyx-lobes half as long as the petals.—This is one of the commonest forms of Rose Geranium. A typical leaf is well depicted in Fig. 1707 (lower figure).

15. **Rádula,** Ait. Fig. 1707. Differs from *P. graveolens* in the narrower divisions with revolute margins of the lvs.: the lvs. are deeply palmately parted, the lobes narrow-linear and pinnatifid, all rough-hispid on the upper surface and soft-pubescent beneath: fls. small, pale purple, with dark streaks.—Does not appear to be in the trade in a pure form, but the narrow-lvd. Rose Geraniums are probably hybrids between this and *P. graveolens*.

16. **denticulàtum,** Jacq. Fig. 1708. Much like *P. Radula*, but the leaf-lobes very denticulate and flat: lvs. glabrous and viscid above, plant weaker.—It has a balsamic odor. Perhaps it has entered into the garden forms of Rose Geranium.

ccccc. *Lvs. small, round-cordate, 3-lobed half their depth and the margins toothed or jagged.*

17. **crispum,** Ait. Much branched and very scabrous or rough; lvs. 2-ranked, small and rigid, short-stalked, cuneate, truncate or slightly cordate at base, coarsely toothed: fls. 2–3 on short peduncles, violet, the lower petals narrow.—A neat, strict-growing plant with lemon-scented foliage. Probably not in general cultivation now in a pure form.

1709. Pelargonium Limonium. (×⅓.)

18. **Limònium,** Sweet. Lemon Geranium. Fig. 1709. Lvs. larger than in the last, not 2-ranked, soft: fls. purple and lilac.—A garden hybrid, *P. crispum* apparently being one of its parents. There is a form with variegated lvs. Sometimes known

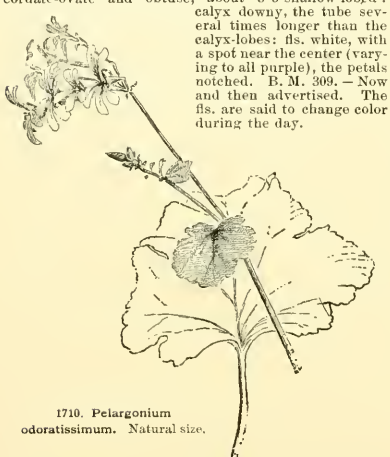
to gardeners as *P. odoratum*. It is a neat and worthy plant, and showy when in flower. It has a lemon or palm scent. The variety known as Lady Mary is of this group.

B. *Stipules very minute and adnate.*

19. **exstipulàtum,** Ait. Resembles *P. crispum* in habit and foliage: lvs. round-ovate, small, velvety, about 3-lobed, the lobes cut-toothed or lobed: peduncles slender, with very small bracts: fls. small, white, with short spatulate petals.—Lvs. about ½ in. across, with odor of pennyroyal. Appears not to be in the trade, at least not in a pure form.

AAAA. *Plant with a short and thick more or less fleshy stem or caudex, from which arise slender branches, the lvs. long-stalked and reniform or cordate and obscurely lobed: stamens 6 or 7.* (*Cortusina.*)

20. **echinàtum,** Curt. The fleshy caudex armed with persistent spine-like stipules: lvs. white-tomentose, cordate-ovate and obtuse, about 3–5-shallow-lobed: calyx downy, the tube several times longer than the calyx-lobes: fls. white, with a spot near the center (varying to all purple), the petals notched. B. M. 309.—Now and then advertised. The fls. are said to change color during the day.



1710. Pelargonium **odoratissimum.** Natural size.

21. **odoratissimum,** Ait. NUTMEG GERANIUM. Fig. 1710. Stem or caudex very short, throwing up many slender and weak soft-pubescent branches: lvs. very long-stalked, soft, round-cordate and very obtuse, obscurely 3- or more-lobed, the margins dentate-crenate: peduncles long and borne opposite the lvs., 5–10-fld.: fls. small, white, the petals about twice longer than the calyx-lobes.—A common plant, cult. for its pleasant-scented foliage. The plant known to gardeners as *P. fragrans* is either this species or a close derivative from it.

AAAAA. *Plant with short stem and tuberous roots, the lvs. pinnate or pinnately parted, the fls. in many-fld. umbels.* (*Polyactium.*)

22. **trìste,** Ait. Stem or caudex very short, succulent: lvs. large, 2–3-pinnately compound pubescent, the ultimate teeth gland-tipped: calyx-tube long and stalk-like, much exceeding the pedicel, the lobes half as long as the petals: fls. brown-yellow with dark spots. B.M. 1641.—A well-marked species, occasionally offered in the trade.

23. **quinquevùlnerum,** Willd. Somewhat shrubby at base, sparingly branched, hirsute: lvs. 2-pinnatifid with linear toothed segments, the stipules broadly cordate and mucronate: fls. purple, scentless, the petals obovate, velvety and pale-edged; calyx-tube as long as the pedicels, somewhat hairy, the lobes obtuse.—Once offered by Saul.

24. **fùlgidum,** Willd. Stem shrubby, densely pubescent: lvs. pinnately 3-parted, silky on both sides, the central segments 3-lobed, all deeply toothed: peduncles usually branched, many-fld.: fls. small, bright scarlet, the petals obtuse; calyx-tube conspicuously swollen at the base and again just underneath the flower, thrice as long as the pedicel, the lobes linear-obtuse.—Not now seen in its pure form, but it is probably a remote parent in various small-flowered scarlet Geraniums.

L. H. B.

PELECÝPHORA (Greek, *hatchet-bearing;* from an alleged resemblance in the tubercles). *Cactàceæ.* HATCHET CACTUS. Stems globular, short-cylindric or elavate, small, often cespitose: tubercles strongly compressed from the sides; areolæ very long and narrow, bordered on each side by a row of about 20 very short, appressed comb-like spines: fr. naked. A genus of 2 species closely allied to Mammillaria.

aselliformis, Ehrb. (from a fancied resemblance to Asellus, the wood-louse). Fig. 303, Vol. I. Juice watery: tubercles ashy green, more or less deeply grooved to the woolly axil; spines not projecting beyond the margin of areola: fls. purple with paler sepals: fr. near the center, red. Nuevo Leon and San Luis Potosi, Mex. I.H. 5:186.—Var. **cóncolor** has pure purple fls. B.M. 6061.

pectinàta, Schum. Juice milky: tubercles bright green with naked axils; spines projecting a little beyond the margin of tubercle: fls. yellow, lateral. Oaxaca, Mex. KATHARINE BRANDEGEE.

PELICAN FLOWER. *Aristolochia grandiflora.*

PELLÆA (Greek, *pellos,* dusky; from the usually dark-colored leaf-stalks). *Polypodiàceæ.* A genus of small, rock-loving ferns, with the sori at the ends of free veins forming a mostly continuous marginal band around the segments and covered by the more or less changed margin of the segments. Most species thrive best on limestone rocks.

A. *Lvs. simply pinnate.*

B. *Lfts. 4–5 pairs.*

Pringlei, Dav. Lvs. with 4–5 pairs of large triangular hastate stalked lfts. 1 in. or more either way: sorus forming a wide marginal band. Mexico.

BB. *Lfts. 5–8 pairs.*

Bridgesii, Hook. (*Platylòma Bridgesii,* J. Sm.). Lfts. subsessile, orbicular or subcordate, 4–5 lines long: sori confluent in a broad intramarginal band. Calif.

BBB. *Lfts. 20–40.*

rotundifòlia, Hook. Lfts. short-stalked, oblong or roundish, entire, obtuse. New Zealand.

falcàta, Fée (*Platylòma falcatum,* J. Sm.). Lfts. nearly sessile, lanceolate or lanceolate-oblong, mucronate and often slightly falcate, sori in broad lines. India to Australia and New Zealand.

AA. *Lvs. bipinnate.*

B. *Pinnæ formed of 3 sessile lfts.*

ternifòlia, Fée. Lvs. 6–12 in. long on strong dark chestnut stalks, narrow, with 6–12 opposite pairs of pinnæ; lfts. closely rolled together, linear. Trop. Amer.

BB. *Pinnæ (at least the lower ones) pinnate.*

Wrightiàna, Hook. Lvs. 3–6 in. long, 1–3 in. wide, deltoid; pinnæ with several linear-oblong pinnules on each side ¼ in. long, with inrolled edges and a sharp mucronate point. Texas to California.

atropurpùrea, Link. Lvs. 4–12 in. long, 2–6 in. wide, lanceolate to ovate-lanceolate, with several pinnules which are sessile, auricled or heart-shaped at the base, the broad line of sporangia nearly hiding the narrow marginal indusium. Eastern America to the Rocky mountains.

AAA. *Lvs. at least tripinnatifid.*

C. *Shape of lvs. triangular-deltoid, with narrow ultimate divisions.*

dénsa, Hook. CLIFF BRAKE. Lvs. 2–3 in. long, 1–1¼ in. wide, on slender brown stalks; segments linear with enrolled edges sharp-pointed; indusium permanently covering the sori. Pacific North America.

cc. *Shape of lvs. elongate, ovate or lanceolate.*

andromedæfòlia, Fée. Lvs. 6–12 in. long, 3–6 in. wide; ultimate divisions 1½–2 lines long, linear-oblong, with enrolled edges. California.—Sometimes known as the Coffee Fern.

hastàta, Link. Lvs. 6–24 in. long, 6–12 in. wide; ultimate divisions ovate or lanceolate, 1–2 in. long, nearly sessile: sori in a narrow marginal line. Eastern and south Africa. Small lvs. are sometimes only bipinuate.

P. Stélleri, Beddome (P. gracilis, Hook.), a rare membranous species of the eastern states, is more closely allied to the genus Cryptogramma, to which Prantl has referred it.

L. M. Underwood.

PELLIÒNIA (J. Alphonse Pellion, officer in Freycinet's voyage round the world). *Urticàceæ.* Of this genus we cultivate 2 choice tender creeping foliage plants, suitable for baskets and for the borders of greenhouses under the benches. The genus contains about 20 species of herbs, often creepers, rarely subshrubs from tropical and eastern Asia and the Pacific islands. They have alternate, 2-ranked lvs. which are unequal at the base, entire or serrate: fls. monœcious or dioecious, in dense cymes; perianth segments 5, rarely 4, in fruit sometimes unchanged but usually increased and investing the fruit. The following are glabrous plants from Cochin China, with lvs. about an inch long and half as wide, and slightly crenate at the margin. All the species known to science are oriental. One of the species was once advertised as a Peperomia.

Daveauàna, N. E. Br. Lvs. dark bronzy olive-green more or less flushed violet or red, with a fern-like figure of light green down the middle of the leaf, the figure being narrowly oblong and crenate. This figure is sometimes absent from some of the lvs. The lvs. are more acuminate than in the next. R.H. 1880:290 (as *Begonia Daveauana,* a charming picture). I.H. 29:472 (poor).

pùlchra, N. E. Br. Lvs. dull blackish along the midrib and veins, the inter-spaces being light green, the under surface pale purplish. I.H. 30:479. A.G. 15:4.

W. M.

PELLITORY. *Parietaria;* also an uncommon name of Feverfew, *Chrysanthemum Parthenium.*

PELORIA. See *Teratology.*

PELTÁNDRA (Greek, referring to the peltate anthers). *Aroìdeæ.* Arrow Arum. An east American genus with two species which have been much confused. They are stemless herbs, the glossy arrow-shaped leaves arising from strong underground parts: fls. monœcious and naked, the staminate ones on the upper part of the long spadix, the anthers sessile and imbedded and opening by terminal pores, the 1-loculed ovaries attended by 4 or 5 scale-like bodies or staminodia: spathe usually exceeding the spadix: fr. a 1–3-seeded, mostly leathery berry, borne in large globose clusters. Peltandras are excellent subaquatic plants, their large thick sagittate leaves always adding variety and interest to margins of ponds and to bog gardens. Single specimens or clumps are usually most prized. Peltandras are easy to colonize.

undulàta, Raf. Lvs. narrow-sagittate, the basal lobes long and nearly or quite acute: spathe 4–8 in. long, green, convolute around the spadix for its whole length: sterile part of the spadix much longer than the pistillate part: fr. green, 1–3-seeded. In shallow pools or bog margins, N. Eng. to Fla. and W. A.G. 1893:111.—The root is composed of thick cords or fibers.

álba, Raf. Lvs. broader, the basal lobes short: spathe white, the upper part expanded and calla-lil e: sterile part of spadix little, if any, longer than pistillate part: fr. red, 1-seeded. Va., S.—Root tuberous. L. H. B.

PELTÓPHORUM (Greek, *shield-shaped;* referring to the peculiar stigma). *Leguminòsæ.* Six species of splendid tropical trees, belonging to the same tribe with the gorgeous Poinciana and Cæsalpinia, all of which represent a type of structure widely different from our northern pea-shaped flowers, as they have 5 distinct petals which are all about the same size and shape. There is a fine colored plate of a Peltophorum in Blanco's "Flora of the Philippines," where the golden yellow fls. are nearly 1½ in. across, a dozen of them in each raceme, and 4 racemes uniting to form a great panicle. The Philippine species, *P. inerme,* is probably the same as the Australian one, *P. ferrugineum,* which Franceschi has introduced at Santa Barbara, Calif., but reports so far unsuccessful. Peltophorums have the Mimosa type of foliage. Each leaf of *P. ferrugineum* has 8–10 pairs of pinnæ, and each pinna 10–20 pairs of leaflets.

Generic characters: petals 5, roundish; stamens 10, free, declinate; filaments pilose at base: ovary sessile, 2 to many-ovuled; pod flattish, indehiscent, with narrowly winged margins.

Peltophorum is distinguished from Cæsalpinia and Poinciana by the valvate calyx segments of the latter, while the two former have their calyx segments strongly imbricated. The peculiar stigma of Peltophorum readily distinguishes it from its close allies, Cæsalpinia and Hæmatoxylon (log-wood).

ferrugíneum, Benth. (*P. inérme,* Naves). Tree attaining 100 ft., taking its specific name from the dense rusty tomentum which covers the young branches, petioles and inflorescence: pod 3–4 x ¾–1 in. wide, bearing 1–3 seeds. Australia, Philippines. W. M.

PENNISÈTUM (*penna,* a feather; *seta,* a bristle). *Gramíneæ.* Contains about 40 species of the tropical regions. One species, Pearl Millet, is cultivated for fodder. The genus is allied to Panicum and Setaria, the spikelets being 1-fld., with usually 4 glumes, surrounded at base by a cluster of bristles and arranged in spikes or spike-like racemes. First glume very small, second longer than fl.-glume. The bristles fail with spikelets instead of remaining attached to raehis as in Setaria.

1711. Pennisetum villosum. *P. longistylum* of gardeners.

villòsum, Brown (*P. longístylum* of florists, not of Hochst.). Fig. 1711. Spike broad, 2–4 in. long, and feathery from the bearded bristles: culm 1–2 ft. high, pubescent below the spike. Abyssinia. R.H. 1890, p. 489.

Rüppellii, Steud. (*P. Rupelliànum* of some works). Culms taller and spikes longer and more graceful than the preceding. Abyssinia. R.H. 1897, pp. 54, 55. I.H. 42, p. 206 (1895).

typhoideum, Rich. (*Penicillària spicàta*, Willd.). Pearl Millet. Culm 3–8 ft., bearing a close cylindrical spike 3–10 in. long, ¾ in. thick, pubescent below the spike: lvs. long and broad. Native country unknown. Occasionally grown in the southern states, where it ripens seed. May be grown farther north for forage.—A luxuriant annual long cult. in the Old World for forage and more or less for the fruit, which is used as food.

Japónicum, Trin. (*P. compréssum*, R.Br. *Gymnòthrix Japónica*, Kunth.). A low annual with long narrow lvs. cult. for ornament. Culm 2–3 ft., scabrous, especially under the dense cylindrical spike; bristles unequal, naked. Australia.

macroùrum, Trin. (*Gymnòthrix caudàta*, Schrad.). A tall perennial with stout culm bearing a dense pointed spike about a foot long. Bristles naked. South Africa. —Cult. for ornament.

latifólium, Spreng. (*Gymnòthrix latifòlia*, Schult.). An ornamental perennial. Culm 3–4 ft., bearing several nodding spikes 1–2 in. long: lvs. lanceolate, ½ in. broad: bristles short, naked. Argentine Republic. R.H. 1890, p. 546.

A. S. Hitchcock.

The fine plumy grass known to gardeners as *Pennisetum longistylum* is much used for bedding. It is, perhaps, the finest dwarf grass which is grown chiefly for its flowers. It sometimes survives the winter at Washington, D.C., but should always be treated as a tender subject. Plants raised every year from seed are satisfactory if seed is sown early enough, but divisions of old plants will give larger pieces which flower sooner and require less attention than seedlings. The old plants may be wintered anywhere out of reach of frost. About February 1, in the latitude of Washington (a month later North), cut off the old leaves to within 6 in. of the crowns: divide the clumps into small pieces, trim the roots so that they will ultimately go into 3- or 4-in. pots, and place the pieces thickly together in boxes of sandy soil in a greenhouse with a temperature of about 60°. As soon as new roots have started pot the young plants. They may be removed to a coldframe long before the soft bedding material demands all the available indoor space.

G. W. Oliver.

PENNSYLVANIA, HORTICULTURE IN. Fig. 1712. During the past century Pennsylvania has been prominently before the world because of its mineral wealth. The ruins of many iron works located in rural districts are now reduced to the primitive stone masonry of the smelting furnace, but mark the places of great activity previous to 1850. Later, these industries were concentrated in towns and cities, where, with improved appliances, new methods of transportation and greater facilities for handling labor and capital greatly lessened cost of production and increased the capacity of furnaces. Now, at the close of the nineteenth century, a vast majority of the once profitable iron-ore beds is exhausted or forsaken because of richer fields discovered in other states. Coal, both bituminous and anthracite, is still most actively mined, and extensive areas are sacrificed by farmers to the coal digger in the western counties and in the anthracite region in the northeast. The same may be said of the northwestern section, yielding petroleum and gas.

The forest operations in Pennsylvania have long ago passed the high-water mark of their activity. The white pine forests of the Alleghany mountains, the stretch of hemlock spruce which covered the belt of counties touching the western slope of the Alleghany mountains, and the groves of cherry and black walnut are fast disappearing. Formerly Pennsylvania stood first among the states in the output of forest products. Originally the state was essentially covered with forest, but now Dr. J. T. Rothrock, Forestry Commissioner of Pennsylvania (Report of 1895), declares that less than 36 per cent of the area of the state is in timber.

Pennsylvania has an area of 45,215 square miles, nearly rectangular in outline—157.76 miles broad between the northern and southern boundaries by an average length of 285.85 miles running due east and west. This area is crossed slantwise by the broad band of Appalachian mountains, making three distinct topographical regions.

The eastern region comprises all that territory lying southeast of the Kittatinny mountains, or a line drawn from Franklin to Northampton counties. It is gently undulating, rising in places to great hills which assume the proportions of a mountain in the South mountain range. This region was first settled and is now mostly cleared and cultivated. The richest lands of the state are found in this section.

The central or mountain region is a belt about 50 miles broad, made up of parallel mountains and narrow valleys comprising one-fourth the area of the state. The western boundary of this region is the Alleghany mountains, the greatest of them all. The valleys are covered for the most part with excellent grain land, but the hills and mountain slopes are stony and more or less barren.

The western and largest region has an area of 24,861 square miles, or about 55 per cent of the entire state. It is essentially a high plain, marked in the north, where the elevation is greatest, by deep-seated streams or cañons, some of them 500–800 feet deep. The elevation gradually decreases toward the southwest. There is much land so recently cleared that no attempt has yet been made to utilize it for agricultural or horticultural purposes. There is no question, however, but that much of it could be easily put into condition for fruit culture.

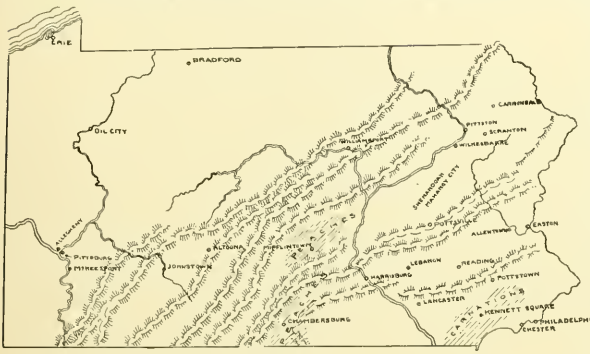
The statistics of 1890 show that Pennsylvania has 18 seed farms, covering an area of 6,066 acres. The seeds extensively produced here are beans, cabbage, carrot, field corn, cucumber, lettuce, parsnip, onion sets and potatoes. Several of the largest seed houses of the United States are located in Philadelphia, that of David Landreth having been established in 1784. There were reported for 1890 311 nurseries, with a total area of 6,598 acres, representing a value of more than $3,000,000. The stock chiefly grown is made up of apples, cherries, peaches, pears, plums, deciduous and evergreen trees and shrubs. In the cultivation of ornamental plants and the production of cut-flowers Pennsylvania takes a prominent place. The census of 1890 was the first to take notice of this industry and shows 544 establishments, with a total of 6,066,144 square feet of glass, being second only to New York. The size of these establishments ranges from 300 to 100,000 square feet of glass. The largest number of roses was propagated in Pennsylvania in the year these statistics were gathered. The largest total values of plant sales were respectively in New York, Pennsylvania and California; and the largest total values of cut-flower sales were respectively in New York, Illinois and Pennsylvania. In truck farms Pennsylvania joins with New Jersey and New York in forming the most important district of America. This district excels all others in the production of beets, cabbage and tomatoes, and has large acreages in asparagus, beans, celery, cucumbers, melons, peas, Irish and sweet potatoes.

The fruit interests of the state are not as great as they should be. Apples are grown successfully in the larger part of the territory, but mainly for home or local consumption. A few orchards of commercial extent have been planted in the last quarter century. The best varieties for market are York Imperial, Smith Cider, Fallawater (all of Pennsylvania origin), Baldwin, R. I. Greening and Ben Davis. Peaches are now grown extensively in two sections in and about Franklin and Juniata counties, known respectively as the "South Mountain" and the "Juniata" peach belts: each belt reports an area of 3,000 acres devoted to peaches. W. G. Waring has observed that "peach trees in Pennsylvania grow to a much larger size and greater age than along the Atlantic shore." Plums and cherries are not extensively grown. Grapes are adapted to this state, but nowhere except in Erie county has the extension of vineyards been rapid, and there it was due to the influence of the Chautauqua grape belt of New York, of which the Erie county vineyards form a part. More attention was given to pears 40 years ago than now on account of the present fear of the "fire blight." Pennsylvania has contributed some of the most valuable varieties of pears now in cultivation, such as the Seckel,

Tyson, Brandywine, Ott, Jones and Kingsessing; also the Kieffer, now a leading commercial variety.

In floriculture a portion of Chester county has become noted as the "carnation belt" because of the numerous establishments there making specialties of producing the cut-flowers and breeding improved varieties.

The Bartram Garden was the first attempt in the United States to gather plants and trees for the purpose of study. See p. 758. It was established in 1728 by John Bartram along the Schuylkill river. It is now in that part of Philadelphia known as Kingsessing.



1712. Pennsylvania, to illustrate some of the horticultural regions.

Through the untiring and zealous efforts of that broad-minded horticulturist, Thomas Meehan, the city of Philadelphia in 1891 purchased 12 acres of land from the Eastwick estate, which contained the original garden, and thus the preservation of this old horticultural monument seems to be assured. It is now only one of many small parks possessed and cared for by the city of Philadelphia. The principal parks of the state are Fairmount Park in Philadelphia, in which definite work was begun about 1860; the buildings of the Centennial Exposition were placed on these grounds in 1876. It has an area of 2,200 acres and is well maintained. Allegheny parks occupy the ground formerly known as the Commons in Allegheny City. Of more recent establishment are Schenly and Highland Parks, in Pittsburg. The cemeteries of the larger cities are in the hands of competent superintendents, and the park ideas of landscape and ornamentation are becoming the prominent features of these sacred grounds.

GEO. C. BUTZ.

PENNYROYAL of Europe, *Mentha Pulegium*; of America, *Hedeoma pulegioides*. **Bastard P.**, or Blue Curls, is *Trichostema dichotomum*. All are members of the Mint family.

The garden Pennyroyal, *Mentha Pulegium*, is a European perennial, used for seasoning. It is one of the "sweet herbs." It is easily grown, profiting by a winter protection of leaves or litter. Prop. by seeds or division. Beds should be renewed frequently.

PENTACHÆTA (Greek, referring to five bristles at the base of the pappus). *Compósitæ*. Six species of low, slender, Californian annuals with thread-like, alternate lvs. and small or medium-sized heads, the rays when present usually yellow, sometimes white: the disk-fls. sometimes turning purple. *P. aúrea*, Nutt., growing 3–12 in. high and with 7–40 deep golden rays, was offered by Orcutt in 1891 and was pictured in Gt. 1153, but has no horticultural standing.

PENTÁPETES (Greek, *having 5 leaves;* an ancient name of some cinquefoil, transferred by Linnæus to this plant, which has 5 leafy growths (staminodes) accompanying the stamens). *Sterculiàceæ*. A pretty red-fld. tender annual, widely distributed in tropical Asia and beautifully figured in Blanco's "Flora of the Philippines," but rare in European gardens and unknown in America. It is a branched plant growing 2–5 ft. high, with fls. which open at noon and close at the following dawn. The fls. are nearly 1½ in. across, 5-petaled, axillary, short-peduncled. Recommended to lovers of rare, tender annuals.

A genus of one species. Bractlets 3, caducous; sepals 5, lanceolate, connate at the base; petals 5; stamens 20, connate at the base, 15 fertile in 5 groups of 3 each, alternating with 5 staminodes which are nearly as long as the petals: ovary 5-celled; cells many-ovuled: capsule loculicidally 5-valved: seeds 8–12, in 2 series in each cell.

phœnícea, Linn. Lvs. 3–5 in. long, 1-nerved, crenate-serrate; petiole 1 in. long; stipules awl-shaped. B. R. 7:575.

PÉNTAS (Greek, *five;* referring to the floral parts; which, however, is not strictly true of the genus nor a rarity in the family). *Rubiàceæ*. Nine species of tender herbs and subshrubs, resembling Bouvardias of the same family, but not their closest ally. They are all natives of tropical Africa, except one which comes from Madagascar. The favorite species is *P. carnea*, whose color varieties range through lilac and flesh color to crimson-pink and rosy purple. A good cluster is 3 in. across and contains 20 or more fls., each of which is ½ in. across. The fls. are about ¾ in. long, funnel-shaped, and generally have 5 spreading lobes, sometimes 4 or 6. It is usually grown like Bouvardia in warm conservatories for winter bloom, but it is sometimes used for bedding in warmer countries, as it gives three months of rather showy bloom when treated like Lantana. In general, the species seem to be less worthy than Bouvardias.

Generic characters: Herbs or subshrubs, erect or prostrate, hispid or tomentose: lvs. opposite, stalked, ovate or ovate-lanceolate; stipules multifid or multisetose: inflorescence usually corymbose: calyx-lobes 4–6, inequal; corolla pilose, the long tube dilated and villous in the throat; lobes valvate; stamens 4–6, inserted below the throat; filaments short or long; anthers fixed at the back, included or exserted: disk tumid or annular, often produced into a cone after anthesis: ovary 2-loculed: ovules numerous: style-branches papillose; capsule membranous or leathery, 2-loculed, loculicidal; seeds minute. Six species are given in the Flora of Tropical Africa 3:45 (1877).

A. *Fls. not white.*

cárnea, Benth. Erect or decumbent, 1–2 ft. high, shrubby at base, merely puberulous, not at all rusty-hairy: lvs. 1–6 in. long, 4½ lines to 2 in. broad, ovate, elliptic or lance-oblong: cymes peduncled or not. B.M. 4086. B.R. 30:32. R.B. 21:217. Gn. 21, p. 329. J.H. III. 30:209. R.H. 1870:130 (var. *kermesina*). Var. **Quartiniàna** (*P. Quartiniàna*, Oliv.) is a rosy-fld. var. said to be much better than the type. Gt. 45, p. 464.

AA. *Fls. white.*

lanceolàta, Hort. This novelty of 1900 is figured in Dreer's catalogue, which says, "A pretty half-shrubby greenhouse plant, not unlike a Bouvardia in general appearance, but flowering more profusely and continuously. It may be planted in the open border during the summer, but it is valuable chiefly as a winter-flowering pot-plant, for which purpose it is especially well suited, being in flower all the time. The pure white flowers are produced in flat heads of 15 to 30 flowers each, similar to a Bouvardia, but much larger, and last in perfection a long time."

W. M.

PENTLÁNDIA. See *Urceolina*.

PENTSTÈMON (Greek for *five stamens*, all 5 stamens being present, whereas related genera have only 4; but in Pentstemon one of the stamens is commonly sterile). *Scrophulariàceæ*. PENTSTEMON. BEARD-TONGUE. For the hardy border, Pentstemons are most satisfactory plants, and the great number of showy species allows much latitude in choice of color and habit. All are perennial, but some of them bloom the first year from seed. In a dry and hot place they are likely to be short-lived, although nearly all the species thrive best in full exposure to sun. They are not particular as to soil. They are propagated by division and by seed. Many of the species are not hardy in the northern states, but *P. barbatus* and its varieties, *P. pubescens*, *P. laevigatus* and variety, *P. confertus* and variety, *P. diffusus*, *P. ovatus*, *P. grandiflorus*, *P. acuminatus*, *P. caeruleus*, *P. glaber* and varieties, and also others, may be expected to stand in the North, particularly if given a protection of leaves. An excellent garden race has been produced, here designated as *P. gloxinioides*. This seems to be a product of hybridization and selection. It is little known in American gardens, although it is a handsome and deserving plant. Some of the forms of it are treated as annuals.

Pentstemon is a typical American genus. One species is native to northeastern Asia and several to the cooler parts of Mexico, but the larger number of the 100 species inhabit the United States and Canada, particularly the western parts. They are all herbs, although some species are somewhat woody at the base. They bear long-tubular often 2-lipped flowers in terminal usually interrupted or leafy clusters. The anther-bearing stamens are 4, the cells of which are united or confluent at the apex but separate at the base; the fifth stamen is represented by a prominent sterile filament (which rarely bears an anther). The style is filiform and the stigma entire; the fruit is a globular-pointed capsule, containing wingless seeds.

It is difficult to so arrange the species of Pentstemon as to make them easy of determination by the horticulturist. There is no monograph of all the species, but Gray's account in the Synoptical Flora (Vol. 2, Part 1) describes the American species north of Mexico; and this account has been closely followed here. The arrangement of species, however, has been modified considerably to admit the Mexican species and to make the group easier for the beginner. The following account contains all the Pentstemons, with one exception, known to be in the Amer. trade. This exception is "*P. rubicaulis*; 1 ft., rich crimson, from Oregon," which is in the trade but unknown to the writer. Other species are mentioned in Old World literature. Other native species will appear in the Amer. trade: these may be found in Gray.

INDEX.

A. *Cells of anthers deliscent for nearly or quite their whole length, united or connivent at the apex and soon spreading from each other.* (AA. No. 32.)

B. *Anthers covered with long wool.*

1. **Ménziesii,** Hook. Woody at base, 1 ft. or less high: lvs. thick, obovate to oblong, serrate or entire, mostly glabrous, the lower ones short-stalked: cluster a raceme, pubescent. fls. 1 in. or more long, violet-blue to purple, usually 1 on each pedicel, the upper lip 2-cleft and the lower 2-cleft. Wyo., west and northwest.

Var. **Newberryi,** Gray (var. *Róbinsoni*, Mast.). Fls. pink or rose-purple. Calif. G.C. 1872:969.

Var. **Douglasii,** Gray (*P. Dóuglasii*, Hook. *P. crassifólius*, Lindl.). Fls. lilac-purple, pink at base: lvs. oblong or obovate-lanceolate, entire. Ore., north. B.R. 24:16.

Var. **Scoùleri,** Gray (*P. Scoùleri*, Lindl.). Fls. violet-purple: lvs. lanceolate to linear-lanceolate, sparsely serrulate. Ore., north. B.R. 15:1277. B.M. 6834. G.C. III. 7, p. 204. Gn. 52, p. 42.

BB. *Anthers glabrous or only hairy (not woolly).*

C. *Plant semi-scandent (somewhat climbing) by means of long, slender branches.*

2. **cordifólius,** Benth. Plant very leafy, somewhat pubescent: lvs. ovate, serrate, 1 in. or less long. cluster or thyrse short and leafy, the peduncles several-fld.: corolla tubular, scarlet, the tube 1 in. long and the limb half as long. S. Calif. R.H. 1850:221.

CC. *Plant erect, self-supporting.*

D. *Corolla lemon-yellow to yellow-red.*

3. **antirrhinoides,** Benth. (*P. Lóbbii*, Hort.). Plant 1–5 ft., glabrous or nearly so, branched and leafy: lvs. small, oval or spatulate, entire: fls. in leafy panicles, the peduncles 1-fld., the broad fls. about 1 in. long, the lower lip deeply 2-lobed; sterile filament bearded on one side. S. Calif. B.M. 6157. I.H. 9:315.

4. **Lémmoni,** Gray. Slender shrub, 5 ft. or less tall, bright green and glabrous: lvs. ovate-lanceolate, toothed. panicle loose and branchy, the long peduncles 2–7-fld.: fls. small, dull yellowish and red, the segments nearly equal. Central Calif.

DD. *Corolla not yellow (unless occasionally in P. confertus), mostly in shades of red or purple, sometimes white.*

E. *Stem and lvs. glabrous, at least up to the inflorescence.* (EE. No. 28.)

F. *Corolla long and slender, not swollen near the base or greatly widened at the mouth: straight-flowered species.*

5. **barbàtus,** Nutt. Tall, erect, branching, glabrous and more or less glaucous herbs: lvs. firm, varying from lanceolate to linear, entire, strong-veined, the radical ones oblanceolate or spatulate: fl.-cluster long and open, narrow, the peduncles about 2–3-fld.: fls. slender, about 1 in. long in wild forms, strongly 2-lipped, varying from light pink and flesh color to carmine, the lower lip usually bearded. Colo., south. B.R. 25:21. R.H. 1896, p. 347. Mn. 7:141.—A showy perennial, and common in cult. One of the best.

Var. **Tórreyi,** Gray (*P. Tórreyi*, Benth.), is a scarlet-fld. form, with almost no beard on the lower lip; the commonest form of the species in cult. Excellent.

Var. **coccíneus,** Hort., is a scarlet-fld. horticultural form.

6. **Hártwegi,** Benth. (*P. gentianoides*, Lindl.). Tall and erect (3–4 ft. high), somewhat branched, the stems dark purple: lvs. lanceolate to lance-oblong-linear, or the upper ones broader, sessile, glabrous and entire: fl.-cluster somewhat pubescent, long and open, the pedicels 3–6-fld.: fls. drooping, dark rich purplish red, slightly curved, the limb somewhat 2-lipped and the lobes acute. Cool regions in Mexico. B.M. 3661. B.R. 24:3. Gn. 37, p. 603; 49, p. 406.—A fine garden plant, now much modified by domestication.

7. **gloxinioides,** Hort. A race of garden hybrids, issuing largely from *P. Hartwegi*; the other most important parent being *P. Cobæa*. Probably other species have entered into the amalgamation. The group needs critical study from the growing plants. The fls. are large, with a broad nearly regular limb, and in many colors. The plants are strong and floriferous. Flowers sometimes measure 2 in. across. Some of the strains bloom freely from seed the first year. Not hardy in New York, unless very thoroughly protected; it is probably better to winter it in deep coldframe.

8. **centranthifòlius,** Benth. Plant strict and leafy, 1–3 ft. tall, very glaucous: lvs. thick and entire, from ovate-lanceolate to linear, mostly sessile and clasping: inflorescence long and narrow, the peduncles 2–3-fld.: fls. about 1 in. long, scarlet, narrow-tubular, the lobes short and acute; sterile filament naked. Calif. to W. Ariz. B.M. 5142. F.S. 22:2309.

FF. *Corolla (except in P. rotundifolius) with a prominently enlarging tube, which is often contracted near the base: thick-flowered species. Corolla nearly straight, but short in P. confertus.*

G. *Leaves entire (sometimes serrulate in P. confertus).*

H. *Dehiscence of anther cells extending from base but not through the apex.*

9. **glàber,** Pursh (*P. Górdoni,* Hook. *P. speciósus,* Dougl.). Erect herb (1–2 ft.), with simple stems, glabrous and somewhat glaucous: lvs. oblong-lanceolate to ovate-lanceolate: fl. 1 in. or more long, broad and wide at the mouth, bright blue to purplish. Mo. river west. B.M. 1672 (as *P. glabra*) and 4319. B.R. 15:1270. Gn. 27, p. 42. R.H. 1895, p. 383; 1896, p. 347.—A very handsome plant, known by its large blue fls.

1713. Pentstemon grandiflorus (×¼).

1714. Pentstemon cæruleus (×¾). A slender form.

Var. **cyanánthus,** Gray (*P. cyánthus,* Hort.). Tall and less glaucous, the lvs. broader (ovate or cordate-ovate to lance-ovate): fl.-cluster dense: fls. bright blue. Rocky Mts. R.H. 1851:453.—Preferable to the type.

HH. *Dehiscence of anther cells extending from the base to the very apex and through the junction or confluence of the two cells at the apex.*

I. *Inflorescence rather close and compact.*

J. *Shape of some or all of the leaves as broad as ovate or obovate.*

10. **puníceus,** Gray. Very glaucous, with short ovate sometimes connate lvs.: fl. about 1 in. long, more funnelform (or widening upwards) and with wide-spreading rounded lobes, scarlet; sterile filament bearded down one side. Ariz. R.H. 1892, p. 448.

11. **Wrìghtii,** Hook. Rather stout, 2 ft. or less tall, more or less glaucous: lowest lvs. obovate, the upper ones oblong and clasping: inflorescence long and loosely fld., to peduncles about 2-fld.: fls. about ¾ in. long, bright red, the mouth broad and the rounded lobes spreading ¾ in. W. Tex. and N. Mex. B.M. 4601. F.S. 7:685.

12. **grandiflòrus,** Nutt. Fig. 1713. Stout, very glaucous: lvs. thick, broad and obtuse, the floral ones with very broad bases: peduncles very short or almost none: fls. nearly or quite 2 in. long, lilac or blue, enlarging near the base, somewhat 2-lipped and the upper lip the smaller; sterile filament minutely pubescent at the tip: fr. large. Wisconsin, south and west.—Handsome.

13. **Murrayànus,** Hook. Erect, 3 ft.: lvs. broad-ovate, clasping, and the upper pairs grown together into a cup-shaped body (connate): pedicels 2–3 in. long: fls. deep scarlet, with rather small lobes; sterile filament glabrous. Tex. B.M. 3472. Gn. 26, p. 229. R.H. 1896, p. 348.

14. **acuminàtus,** Dougl. Glaucous, strict and usually stiffish, 2 ft. or less tall: lvs. thickish, the lowermost broadly ovate to obovate, the uppermost lance-ovate to short-ovate and clasping and usually acuminate, the floral lvs. shorter than the fls.: inflorescence narrow, the peduncles 1–3- or more fld.: fls. nearly 1 in. long, lilac to violet, wide at the throat, the obtuse lobes spreading; sterile filament bearded at the tip. Mo. river, west and south. B.R. 15:1285.—Very satisfactory.

JJ. *Shape of leaves lanceolate to linear.*

15. **cærùleus,** Nutt. Fig. 1714. Mostly lower: lvs. linear to lanceolate, those at the base of the fl.-cluster usually exceeding the fls.: inflorescence usually close: fls. blue, varying to lilac or white. Dakota to Colo.—Seems to run into *P. acuminatus.*

16. **secundiflòrus,** Benth. About 2 ft. tall: lvs. narrow-lanceolate, somewhat glaucous, the radical ones spatulate: inflorescence long and strict, the peduncles 1–3-fld.: fls. lilac or purple, the basal tube about twice the length of the calyx, the throat broad and bell-shaped and about equaled by the spreading rounded lobes; sterile filament glabrous or bearded only at the top. Colo.—Handsome.

17. **confértus,** Dougl. One to 2 ft., pubescent in the inflorescence: lvs. oblong to lanceolate to linear, usually entire but sometimes minutely serrate: inflorescence a narrow interrupted spike, the pedunclès sessile or the lower ones stalked: fls. ½ in. or less long, cream-white to sulfur-yellow, narrow, 2-lipped, the lower lip bearded within. Rocky Mts. to Ore. B.R. 15:1260.

Var. **cærùleo-purpùreus,** Gray (*P. pròcerus,* Dougl.). Fls. blue-purple to violet. Colo., west and north. B.M. 2954. L.B.C. 17:1616.—A common form in gardens, and a reliable and satisfactory plant.

II. *Inflorescence very open and loose, due to the fact that the peduncles are 3–6 in. long and the pedicels 1 in. or more long and the fls. drooping.*

18. **rotundifòlius,** Gray. About 2 ft. tall, branching from the base, glaucous: lower lvs. thick and leathery, orbicular-ovate and obtuse, long-petioled, stem-lvs. sessile and cordate-orbicular: fls. 1–1¼ in long, narrow-tubular, yellow-red, the lobes short and acute; sterile filament glabrous. Northern Mex. B.M. 7055. G.C. III. 4:265. G.F. 1:473.

GG. *Leaves serrate or dentate.*

H. *Sterile filament bearded at the tip or along one side.* (HH. No. 26.)

I. *Color of fls. purple, blue or rose, incidentally ranging to white.*

19. **campanulàtus,** Willd. Branching from the base, 2 ft. or less tall: lvs. lanceolate or the upper ones ovate-lanceolate, long-acuminate, broad at the base and sessile, strongly serrate: inflorescence long and narrow, the peduncles usually 2-fld.: fls. 1 in. long, rose-purple, the narrow base of the tube about the length of the

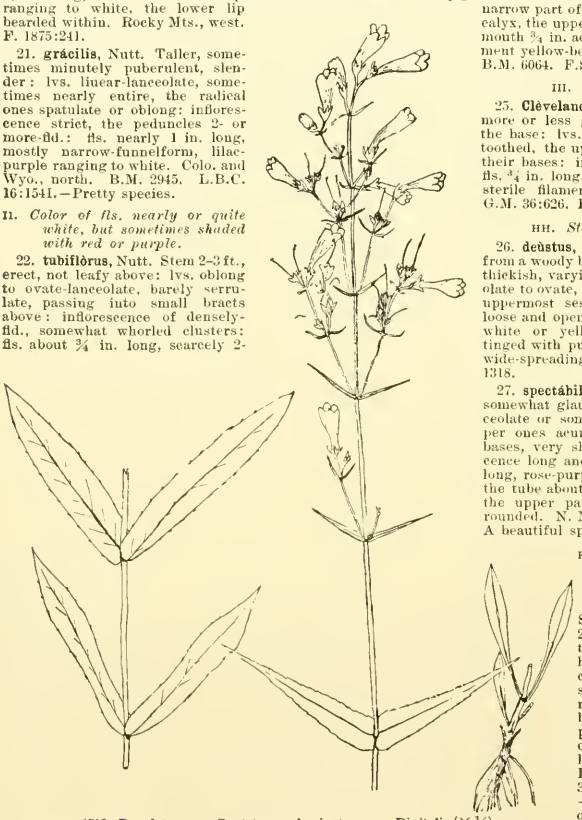
calyx, the upper part broad and ventricose, the subequal lobes rounded and spreading, the throat hairy; sterile filament hairy at the top. Mex. B.M. 3884.—An old garden plant which is variable in color and which has received many names, as *P. angustifolius, atropurpureus, pulchellus, roseus.* See B.R. 13:1122 and 14:1138. L.B.C. 15:1429, 1438.

20. **hùmilis**, Nutt. Low, usually not over 6 in. tall, pubescent in the inflorescence: lvs. oblong to lanceolate, somewhat glaucous, the upper ones small-toothed: inflorescence 3–4 in. long, with 2–5-fld. peduncles: fls. ½ in. long, rather narrow, deep blue or sometimes ranging to white, the lower lip bearded within. Rocky Mts., west. F. 1875:241.

21. **grácilis**, Nutt. Taller, sometimes minutely puberulent, slender: lvs. linear-lanceolate, sometimes nearly entire, the radical ones spatulate or oblong: inflorescence strict, the peduncles 2- or more-fld.: fls. nearly 1 in. long, mostly narrow-funnelform, lilac-purple ranging to white. Colo. and Wyo., north. B.M. 2945. L.B.C. 16:1541.—Pretty species.

II. *Color of fls. nearly or quite white, but sometimes shaded with red or purple.*

22. **tubiflòrus**, Nutt. Stem 2–3 ft., erect, not leafy above: lvs. oblong to ovate-lanceolate, barely serrulate, passing into small bracts above: inflorescence of densely-fld., somewhat whorled clusters: fls. about ¾ in. long, scarcely 2-lipped, the spreading limb nearly as long as the tube, white or nearly so and sometimes tinged with purple. Kans. and Ark.



1715. Beard-tongue—Pentstemon lævigatus, var. Digitalis (× ¾).

23. **lævigàtus**, Solander. Tall and slender, 2–4 ft., more or less glaucous: lvs. rather firm, purplish, somewhat glossy, ovate to ovate-oblong-lanceolate and clasping, the radical ones oblanceolate or broader, all small-toothed: inflorescence long and loose: fls. about 1 in. long, white and sometimes tinged with color, rather slender, narrow at the base, the short lobes not widespreading, the small lower lip bearded at the base. Pa., west and south. B.M. 1425.—A common plant, best known in the form

Var. **Digitàlis**, Gray (*P. Digitàlis*, Nutt.). Fig. 1715. Very tall, 4–5 ft., with larger white abruptly inflated flowers. B.M. 2587.—Sometimes becomes a weed in old fields. It is in cultivation as a border plant.

24. **Pálmeri**, Gray. Plant 2–3 ft. tall, the foliage glaucous: lvs. thick, ovate to oblong-lanceolate, the lower petioled and the upper connate, very sharp-dentate or sometimes almost entire; inflorescence long, mostly glandular: fls. cream-white tinted with pink, the narrow part of the tube about as long as the calyx, the upper part very wide and open, the mouth ¾ in. across and 2-lipped; sterile filament yellow-bearded. Utah, south and west. B.M. 6064. F.S. 20:2094. F. 1874:37.

III. *Color of flowers red.*

25. **Clèvelandi**, Gray. Two ft. or more, more or less glaucous, becoming woody at the base: lvs. rigid, oblong or ovate, sharp-toothed, the upper ones usually connate by their bases: inflorescence long and narrow: fls. ¾ in. long, crimson, with narrow throat; sterile filament bearded at top. S. Calif. G.M. 36:626. F. 1878, p. 149.

HH. *Sterile filament glabrous.*

26. **deùstus**, Dougl. Stems 1 ft. or less tall from a woody base, glabrous throughout: lvs thickish, varying from nearly linear to lanceolate to ovate, some or all of them serrate, the uppermost sessile: inflorescence many-fld., loose and open: fls. not over ½ in. long, dull white or yellowish white and sometimes tinged with purple, wide-mouthed, the lobes wide-spreading. Montana to Calif. B.R. 16: 1318.

27. **spectábilis**, Thurber. Two–4 ft., erect, somewhat glaucous: lvs. ovate to ovate-lanceolate or sometimes oblong, acute, the upper ones acuminate and connate by their bases, very sharp serrate-dentate: inflorescence long and many-fld.: fl. 1 in. or more long, rose-purple or lilac, the narrow part of the tube about twice the length of the calyx, the upper part broad and full, the lobes rounded. N. Mex. to S. Calif. B.M. 5260.—A beautiful species.

EE. *Stem and lvs. more or less pubescent or hirsute.*

F. *Corolla 2 in. long.*

28. **Cobæa**, Nutt. Fig. 1716. Straight and erect, stout, about 2 ft., minutely pubescent: lvs. thick, ovate-oblong to oblong to broad-lanceolate, the upper ones clasping: inflorescence mostly simple and open: fls. very large, reddish purple to white, the base very narrow but the upper part of the flower broad and open, the limb only obscurely 2-lipped; sterile filament bearded. Prairies, Kans., south. B.M. 3465. Gn. 49:1068. Mn. 4:113. —Very showy, and probably one of the parents of the garden race of hybrid Pentstemons.

FF. *Corolla 1 in. or less long.*

29. **cristàtus**, Nutt. Only a few inches high, pubescent, usually viscid above: lvs. linear-lanceolate to narrow-oblong: inflorescence erect, leafy below: fls. about 1 in. long, purplish, rather abruptly dilated above, the lower lip bearded; sterile filament strongly yellow-bearded. Dakota to Colo. and N.—Good.

30. **ovàtus**, Dougl. Stem slender but erect, 2–4 ft., more or less pubescent: lvs. ovate, rather thin, bright green, serrate, the upper ones clasping: inflorescence

erect but lax, the peduncles 2–several-fld.: fls. about ⅔ in. long, blue changing to purple, 2-lipped and the lower lip bearded. Idaho, west and north. B.M. 2903.—Good.

31. **pubéscens,** Solander. Loose-growing, the slender often decumbent stems reaching 2 ft., usually viscid-pubescent: lvs. oblong to oblanceolate, small-toothed, the radical ones ovate to spatulate: inflorescence loose and open, the peduncles 2–3 in. long and the pedicels

1716. Pentstemon Cobæa (× ¼).

often 1 in. long: fls. about 1 in. long, drooping, dull purple or violet or varying to flesh-color, rather narrow, with 2 short lobes, bearded on the palate; sterile filament densely bearded. Dry fields and banks from Ontario south and west. B.M. 1424.—The common Pentstemon of the East, and useful in cult.

AA. *Cells of anthers not dehiscing or opening to the base, the basal part remaining saccate.*

B. *Leaves dentate or serrate.*

C. *Plant viscid and soft-pubescent.*

32. **glandulòsus,** Lindl. (*P. staticifòlius,* Lindl.). Rather stout, 2–3 ft. tall: lvs. rather thin, ovate-lanceolate, acuminate, the upper ones clasping, the radical ovate or oblong, all toothed or serrate: inflorescence narrow, leafy below, the peduncles few–several-fld.: fls. large, somewhat over 1 in. long, lilac, with inflated throat, the lips short and broad; sterile filament glabrous. Idaho to Wash. and Ore. B.R. 15:1262; 21:1770. B.M. 3688.—Showy.

CC. *Plant not viscid, either glabrous or puberulent.*

33. **venùstus,** Dougl. Stem erect, nearly simple, leafy, 2 ft. or less tall, glabrous: lvs. thickish, oblong-lanceolate to ovate-lanceolate, very sharply serrate: inflorescence narrow, not leafy, the peduncles 1–3-fld.: fls. usually exceeding 1 in. in length, somewhat 2-lipped, light purple, somewhat hairy within; sterile filament hairy above. Idaho and Ore. B.R. 16:1309.

34. **diffùsus,** Dougl. Stems about 2 ft. tall, diffuse: lvs. ovate to oblong-lanceolate to cordate-ovate, unevenly and deeply serrate: inflorescence leafy, the pedicels very short: fls. ¾ in. long, light purple, 2-lipped; sterile filament hairy above. Ore., north. B.M. 3645. B.R. 14:1132. R.H. 1872:410.

BB. *Leaves deep-cut.*

35. **Richardsoni,** Dougl. Rather loosely branching: lvs. ovate-lanceolate to narrow lanceolate, deeply cut or pinnatifid, the upper ones not opposite: inflorescence loose: fls. ¾ in. long, light purple; sterile filament somewhat hairy at top. Ore. and Wash. B.M. 3391. B.R. 13:1121. L.B.C. 17:1641.

BBB. *Leaves entire.*

C. *Sterile filament somewhat bearded.*

36. **gracilèntus,** Gray. A foot or more tall from a woody base, naked above: lvs. lanceolate to linear or oblong, glabrous: inflorescence loose, the viscid peduncles 2–5-fld.: fls. ¼ in. long, violet-blue, the lobes very short. N. Calif., Nev., and Ore.

CC. *Sterile filament glabrous.*

37. **lætus,** Gray. About 1 ft. tall, from a woody base, closely pubescent: lvs. lanceolate to linear-lanceolate, the radical ones spatulate: fls. 1 in. long, blue. Calif.

38. **azùreus,** Benth. Erect or ascending, 3 ft. or less, glaucous, sometimes minutely pubescent: lvs. narrow-ovate to narrow-lanceolate: inflorescence loose and open: fls. 1¼ in. or less long, blue to violet, sometimes reddish at the base, the limb about 1 in. across. Calif. B.M. 7504.

Var. **Jaffrayànus,** Gray (*P. Jaffrayànus,* Hook.). Lower (about 1 ft. tall), young stems tinged with red: lvs. oblong to oval or the upper ones ovate-lanceolate, glaucous: fls. large and showy, rich blue and reddish at base and in the throat. Utah to Calif. B.M. 5045. R.H. 1874:430.

39. **heterophýllus,** Lindl. Stems reaching 3–5 ft., from a woody base, the plant mostly green: lvs. varying from oblong-lanceolate above to lanceolate and linear below: inflorescence loose and open, the peduncles usually 1- or 2-fld.: fls. about 1 in. long, pink or rose-purple, very slender at the base but full or inflated above, the lips well marked. Calif. B.R. 22:1899. B.M. 3853. R.H. 1875:110; 1896, p. 348. L. H. B.

PEONY. See *Pæonia.*

PEPERÒMIA (Greek, *pepper-like*). *Piperàceæ.* An enormous genus of tropical herbs, mostly American, including some small but choice foliage plants for conservatory or house decoration. See Fig. 1717. Annual, or perennial by a creeping caudex or by tubers formed at the base: stems prostrate, creeping and thread-like, or erect and slender, or short, thick and succulent: lvs. alternate, opposite, or in whorls of 3–4 (rarely 5–6), entire, fleshy or membranous, often with pellucid dots: fls. minute, usually disposed in a dense spike, as in Fig. 1718; stamens 2; anther cells confluent; stigma sessile in the ovary.

Speaking of *P. arifolia,* var. *argyreia,* J. D. Hooker says (B.M. 5634): "It is a very beautiful plant, and like

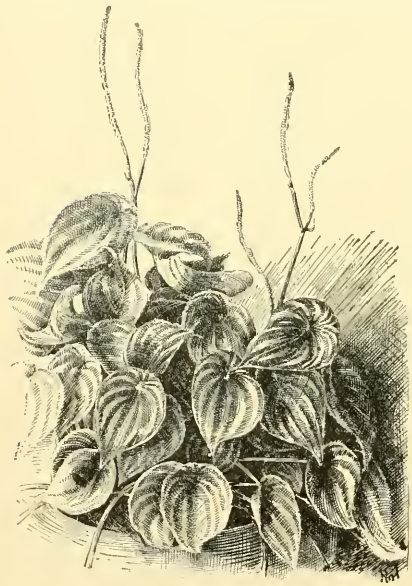
1717. Peperomia arifolia, var. argyreia.
A choice little house plant with variegated foliage.

so many of its congeners, is well adapted for placing along the edge of a shelf in a tropical house, both because of its beautifully marbled leaves and the length of time which these keep in good condition. In fact,

few plants are better adapted for permanent bordering in tropical houses than Peperomias, their leaves varying so much in depth of colour, in marbling, in the different hues of their upper and under surfaces, and in the colour of their stalks; then, too, they are not attractive to insects, make no litter, and give very little trouble in propagating and cultivating."

The plant which seems to be the commonest in cult. here is the one figured in B.M. 5634 as *P. arifolia*, var. *argyreia*. However, DeCandolle thought that this plant was not the true *P. arifolia*, and he renamed it *P. Sandersii* (after Wilson Sanders), but the name is invariably spelled Saundersii in trade catalogues. The distinctions which DeCandolle makes are technical. The main ones are that *P. arifolia* has a short stem and catkins much longer than the lvs., while *P. Sandersii* has no stem and the catkins are about as long as the lvs. In some collections is a plant known as *Peperomia crassifolia*, a name that does not appear in botanical monographs. It is a very distinct species with dark green, ovate, fleshy lvs. 3 x 5 inches, becoming very hard when old; stems branched and upright in habit, a foot in height: fls. in insignificant catkins. It is a very good species and deserves to be more generally known. It is not in the trade, at least not under this name.

The names of Peperomias are much confused, partly owing to the vast size of the genus, which always increases the difficulties of discrimination, and partly to the minuteness of the fls. Moreover, the duration of many kinds is uncertain, while great numbers are



1718. Catkins of Peperomia arifolia, var. argyreia.

monocarpic, that is, they flower and fruit once and then die. The latest monograph is in Latin, DC. Prod. 16, part 1, 392–468 (1869). For important criticisms on the key characters used by DeCandolle, see Hillebrand's "Flora of the Hawaiian Islands." W. M.

Peperomias are very attractive little plants, and their fleshy leaves enable them to endure the dry air of a living room much better than the great majority of plants. While they are essentially warmhouse plants, they will endure a coolhouse temperature for weeks without any apparent harm. They need shade in summer, but none in winter, and require less water than the general run of warmhouse subjects. Never keep them too wet. A loose, lumpy soil with a mixture of broken charcoal suits them well. A pan 3 or 4 in. deep is better for them than a deep pot. They are easily prop. in sand or sandy soil in a bottom heat of 75°, either by the leaf, as with *Begonia Rex*, or with an inch of stem attached. Early spring is the best time to propagate. *P. pubifolia* is well adapted for a hanging basket. *P. maculosa* makes a fine subject for a pan. These, together with *P. arifolia*, var. *argyreia*, and *P. marmorata*, are the best kinds for the florist. WM. SCOTT.

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1. **arifòlia**, Miq. (*P. argyrèa* or *argyrèa*, Hort. *P. Sándersii*, C.DC.). Figs. 1717, 1718. Stemless: lvs. alternate, peltate, 5 × 3½ in.; petioles dark red, 4–8 in. long. Cult. only in the form var. **argyrèia**, Hook., which differs from the type in having broad, parallel longitudinal bands of white between the nerves. Brazil. B.M. 5634. F.S. 23:2438. A.G. 19:17. F.R. 1:637.—Monocarpic annual or biennial.

2. **Verschaffèltii**, Lem. Distinguished from *P. marmorata* by the basal lobes of the lvs., which do not overlap, but are separated by a notch as in a typical cordate leaf. A smaller and more delicate but more branched plant: stem short: stem, branches, petioles and peduncles much longer, translucent and pale rose (not green). Upper Amazon, Brazil. I.H. 16:598.

3. **tithymaloides**, A. Dietr. (*P. magnoliæfòlia*, A. Dietr.). Lvs. alternate, subovate, acutish, 2–3 in. long, base acute, more than 9-nerved; nerves subopposite; petiole 1 in. long, keeled beneath: stem rooting below. Santo Domingo.—Monocarpic annual or biennial.

4. **maculòsa**, Hook. Lvs. alternate (?) ovate-lanceolate, bright shining green, very fleshy; petioles beautifully spotted with purple. Santo Domingo.—A good subject for a pan. Perennial.

5. **metállica**, Lind. & Rod., is distinct from all others here described by its numerous slender, unbranched stems 12–16 in. high and lanceolate lvs. It probably belongs in some other genus or family. It was int. in 1892 before the fls. were known, and there seems to be no subsequent record of fls. Lvs. blackish green, painted white down the middle, red-veined below; petioles short, reddish brown. Peru. I.H. 38:157.

6. **marmoràta**, Hook. Stem short, much-branched, nearly ¼ in. thick: lvs. opposite, ovate-cordate, deeply 2-lobed at the base, the lobes rounded and overlapping. The lvs. are 3–5 in. × 1⅝–2¾ in., not as broad as *P. arifolia* and less concave. Not adv., but has been unnecessarily confused with *P. arifolia*.

7. **latifólia**, Miq. Stem 10 in. high, decumbent: lvs. obovate or obtusely ovate, 5–7-nerved, opposite or in whorls of 3, base acute, glabrous above, pubescent beneath; petiole 7–8 lines long. Sandwich Islands.—Monocarpic annual or biennial.

8. **nummulariifólia**, HBK. Delicate creeper, with long, thread-like, rooting stems and small orbicular lvs., puberulous or glabrate: lvs. alternate, ciliate, obscurely palmately 3-nerved, 3–4 lines in diam. Trop. Amer.—The above description is from Grisebach. Five other species in the West Indies have the same habit. *P. prostràta*, Hort., is probably a syn., but see *P. brevipes*. *P. prostrata* is a stove basket plant figured in G.C. II. 11:717 and F. 1881, p. 103, with a good-sized petiole. The lvs. are very small for the genus, and are said not to exceed two-fifths of an inch. Lvs. bordered and nerved with greenish white. Annual.

9. **brévipes**, C. DC. Lvs. alternate, orbiculate, younger ones hirsute, older ones glabrate, ciliate, 1-nerved: style none: berry with a very short stipe. Trop. Amer.—The above description from DC. Not advertised, but inserted because Nicholson refers *P. prostrata* to this species and keeps *P. nummulariifolia* distinct.

10. **pubifólia**, Veitch. Perennial creeper of unknown habitat, suitable for hanging baskets. Lvs. small, ovate, marked with a central gray bar.

P. resedæflòra, André, int. in 1865, was "found in all stoves" 2 years later and said to be "a plant for the million." It differs from all the above in being a flowering plant rather than a foliage plant, for the lvs. are merely bordered lighter green and the fls. are about as showy as those of a mignonette, each one 3–4 lines long, and 100 or so in a raceme. Stem 1–1½ ft. high, red, forked: lvs. broadly ovate, cordate. Colombia. B.M. 6619. W. M.

PEPINO or MELON SHRUB is *Solanum muricatum*.

PEPÒNIA (Greek, *melon, gourd*). *Cucurbitàceæ*. Seven species of tropical perennial herbs, prostrate or scandent, often villous, with fibrous roots: lvs. lobed or rarely entire, dentate: fls. large, yellow or whitish, monoecious, the males solitary or racemose; petals 5, free, obovate; stamens 3; female fls. solitary: fr. large or medium. One species from Madagascar; the rest African. *P. Mackennii* was int. in southern California with the remark that it is an immense grower and has thick dark green foliage and yellow fls.: but it seems to have been lost from the trade for the present.

Mackénnii, Naud. Distinguished from its congeners by the following characters: lvs. broadly ovate-cordate, 5-lobed to the middle: male fls. solitary; calyx-tube subglabrous, narrowed from apex to base. It is hardly scandent, densely villous and the stem grows ½–6 ft. long: lvs. 4 in. long: petals over 1 in. long: fr. oblong-ovoid, about the size of a hen's egg, green at first, then marbled with white, finally all red; pulp orange-colored, insipid. Natal.

PEPPER. The black and white Pepper of commerce are treated under *Piper*. With American horticulturists "Pepper" usually means the red Pepper (Capsicum, which see) of which the green Pepper is merely the unripe stage.

The red Pepper is doubtless a native of the New World tropics, as there is no record of its having been known prior to the discovery of America. According to Irving's "Life of Columbus," this plant was first mentioned by Martyr in 1493, who says Columbus brought home "Pepper more pungent than that from Caucasus," evidently comparing it with the black Pepper of commerce from the oriental countries. It was cultivated by the natives in tropical and southern America before this time, and about a century later Gerarde speaks of its being brought into European gardens from Africa and southern Asia. The ease with which the plant spreads in warm latitudes, together with the increased commercial trade immediately following the discovery of America, doubtless caused a rapid dissemination through tropical Asia and Africa, where it was supposed by many to be indigenous and from there introduced into European gardens.

The first record of the use of Pepper is apparently by Chauca, physician to the fleet of Columbus, who in 1494 alludes to it as a condiment. Writers about a century later considered it valuable as an aid to digestion and also mentioned its use in dressing meats, dyeing, and other purposes. Medicinally it was much used for various ailments, such as dropsy, colic, ague and toothache, and when mixed with honey and applied exter-

1719, Pepper.
The Ruby King variety.

nally was used as a remedy for quinsy. At a later date preparations were given for black vomit and various tropical fevers and for a tonic, also for gout, paralysis and other diseases. Its modern use is largely as a condiment, forming a seasoning in almost every dish eaten by the inhabitants of warm countries. The smaller varieties are mostly used for this purpose. The cayenne Pepper of commerce consists of the small pungent sorts reduced to a powder. The unground fruit is also made into Pepper sauce of various brands by preserving in brine or strong vinegar. The Tabasco variety furnishes the well-known Tabasco Pepper sauce and Tabasco catsup. "Chilli con carnie" consists of the small pungent varieties finely ground and mixed with meat. These hot varieties are often eaten raw by native Mexicans, as we do radishes, and also form an important ingredient of tomales so common in that country and fairly well known in the southern United States. The large, thick-fleshed sweet varieties are desired more by people farther north, who use them in various ways, served like tomatoes in either ripe or green state, with vinegar and salt, or made into mangoes by cutting one side, removing seeds and filling with chow-chow pickles. The parts are then tied together, placed in jars with vinegar and kept until wanted. The fruit is often used in stuffing pitted olives after being cooked in olive oil. In Spain some are canned after being thus cooked and eaten with French salad dressing. The seed of Peppers is more or less used as a bird food; and the plants of some varieties, like Little Gem and Celestial, are grown more especially for ornamental purposes.

Some 30 varieties are recorded by American seedsmen. They differ from one another mainly in the form and pungency of fruit and habit of growth. There are endless forms among Peppers, but certain types are well fixed, as indicated by the botanical varieties under Capsicum. While all kinds are more or less pungent

about the seeds, the pungency of most of the smaller sorts, like Coral Gem, Tabasco, Chilli, Cayenne, and Cherry extends to the fleshy portion, but as a rule the large kinds, like Ruby King (Fig. 1719), Squash, Bell, Sweet Mountain, and Golden Queen are sweet or very moderately pungent with the seeds removed. Some medium-sized varieties, like Long Red, Celestial, and Oxheart, are hot; others, like County Fair and Kaleidoscope, are mild.

As a rule Peppers are not grown in large quantities in any particular locality, but most gardens near large cities in the central and southern states grow a few to supply local markets.

In growing Peppers the seed is usually planted under glass in February or March, and the young plants transplanted to pots or boxes when of sufficient size to han-

1720. Pepper plant ready to transplant to the field.

dle. From 12 to 20 days are required for the seed to germinate, the time varying according to the age of the seed and the manner in which it has been kept. Its germinating power is said to last four years, and if kept in pods until sown will grow when 6 or 7 years old. A light, warm soil, heavily charged with humus and one that will not quickly dry out, appears to be the best. In May or June, or after all danger of frost is past, the plants (Fig. 1720) are set in the field in rows about 2½ ft. apart and 18 in. apart in the rows. The ground is kept thoroughly cultivated, not only to keep down weeds but to maintain an even but not excessive moisture at all times, which is very essential for best results in growing this plant. By keeping the soil well worked up around the plants they stand up much better against the winds and weight of their own fruit. Pruning or pinching the tip ends after the fruit begins to mature is occasionally recommended, but is rarely practiced except when specimens of especially fine fruit are desired, in which case the fruit is thinned, leaving only a few on each plant of the larger sorts. In gathering, the fruit should not be torn off but cut with a knife or scissors, leaving at least one inch of stem. The usual vegetable crate is used for packing and marketing the crop.

Insects do not injure Peppers growing in the field. Red spider and greenfly (aphis) frequently attack plants growing under glass. The red spider may be kept in check by repeatedly syringing with water, and the greenfly may be killed by fumigating with tobacco dust. Two fungous diseases frequently occur on the large varieties growing outdoors. One is a pink anthracnose (*Glœosporium piperatum*), which causes the fruit to rot about the time it begins to ripen; the other is a dark anthracnose (*Colletotrichum nigrum*).

In preparing Peppers for table use, handle them with gloves to prevent burning the fingers. Neither soap nor water will soothe hands burned by Peppers, but milk will. H. C. Irish.

PEPPER GRASS. *Lepidium.*

PEPPERIDGE or TUPELO. See *Nyssa.*

PEPPERMINT. See *Mentha.*

PEPPERMINT STRINGY BARK. *Eucalyptus piperita.*

PEPPER ROOT. *Dentaria diphylla.*

PERAPHYLLUM (from Greek *pera*, beyond, and *phyllon;* alluding to the crowded leaves). *Rosàceæ.* The only species is a much-branched rigid shrub, with deciduous, alternate, rather small and narrow lvs., white fls. similar to apple-blossoms, in few-fld. upright corymbs appearing with the lvs., and berry-like edible fr. Hardy as far north as Mass., but seems to possess only little ornamental value. It is of very slow growth and blooms only when rather old. It grows in well-drained soil and in sunny position, and is best suited to be planted on rocky slopes of southern aspect. Prop. by seeds and layers and by grafting on Amelanchier or Cratægus. It is closely allied to Amelanchier, but distinguished by its corymbose fls., cylindric calyx-tube, orbicular petals, and also by its narrow lvs. The only species is **P. ramosissimum,** Nutt., a rigid shrub, 2–6 ft. high: lvs. oblong to oblanceolate, almost sessile, entire or spuringly serrulate, silky pubescent when young, ¾–2 in. long: fls. in few-fld. erect corymbs, white or slightly tinged pink, with rose-colored disk, ¾ in. across; petals orbicular spreading; styles 2–3: ovary 2- or incompletely 4-celled: fr. pendulous, globose, brownish yellow, about ½ in. across. May. Ore. to Calif. and Colo. B.M. 7420. Alfred Rehder.

PERENNIALS tend to live from year to year, as opposed to annuals and biennials, which die root and branch the first or second year after flowering and fruiting. Perennials include trees, shrubs and herbs, the two former being woody, the latter not. "Perennials" as commonly used by gardeners is a convenient shortening of the phrase "hardy herbaceous perennials," which includes Peony, Phlox and other non-woody plants whose roots live over the winter while their tops may die to the ground. The phrase "hardy herbaceous perennials" is also shortened in common speech to "herbaceous plants;" or one speaks of his "hardy border." See *Herbs* and *Border.*

A popular fallacy about Perennials lies in the common statement that "they die down every year and come up again in the spring." Many of them never come up. Peonies are as long-lived as shrubbery, and a clump of Fraxinella has been known to outlive father, son and grandson in the same spot. But these are exceptions. The general practice with Perennials is to divide them every second or third year. Nearly all hardy herbaceous plants should be lifted now and then, because the crowns which give the flowers in most desirable kinds flower only 2 or 3 seasons and then die; but the plant may be continually spreading and making new growths, which furnish the flowers, and unless lifted and divided the stocks become scattering and unattractive. Another very good reason for lifting and dividing the Perennials is that, being mostly strong-rooted plants, they deplete the soil.

PERÈSKIA (Nicolaus Fabricius Peireskius, of Aix, France). *Cactàceæ.* Also written *Peireskia.* Shrubby, the slender, often very long branches spreading or climbing; spinose, but the spines not barbed and setæ wanting: lvs. broad, sometimes much like those of the lemon tree: fls. wheel-shaped, more or less paniculate at the ends of twigs; ovary leafy: seeds dark, thin-shelled, with two coverings.

aculeàta, Mill. Lemon Vine. Blad Apple. Barbadoes Gooseberry. Branches woody, rather slender, becoming 10–20 ft. long: lvs. pinnate-veined, 2–3 in. long, 1–2 in. broad: spines at first 2 intra-axillar, short and hooked, later numerous and 1–2 in. long: fls. very pale yellow, sometimes pinkish, 1–1½ in. broad, somewhat paniculed at the ends of the branches: fr. lemon-color, the size of an olive, at maturity nearly or quite smooth. Widely spread in tropical America. B.M. 7147. G.C. III. 20:625.—This species is much used as stock on which to graft other species of Cacti.

Blèo, DC. Fig. 309, Vol. I. Stems stouter, more succulent, less branching: lvs. often 5 in. long by half as wide: spines at first commonly solitary in the axils, later more numerous, all straight: fls. purple, 1½–2 in. broad: fr. 2 in. long, pear-shaped. New Granada, Brazil. B.M. 3478. G.C. III. 20:427.

subulàta, Muehl. Stem 2 ft. or less high, below half wood, above fleshy and branching: lvs. persisting a few years, dark green, shiny, as thick as a pencil, about 3 in. long, half cylindrical and ending in a spine: areolæ felted, in the young plant with a few hair-bristles later with 2–4 straight, pale yellow spines 3–4 in. long. Chile.—Can be used as stock for Epiphyllum.

spathulàta, Otto. Stem upright, with few horizontal, spatulate, shiny green leaves: the diffuse areolæ at first somewhat woolly, later felted, above with a bunch of short bristles, below with 1–2 yellowish white, straight spines. Mex. KATHARINE BRANDEGEE.

PERFUMERY GARDENING. The perfumes of the market are derived in part from animal secretions (musk, civet), in part from artificial chemical compounds, and in part, and chiefly, from the class of vegetable products loosely called essential oils. "Synthetic" or chemical perfumery materials are the more or less perfect artificial reproductions of organic compounds used in perfumery. If it were possible in all cases and with perfect success to compound these substances the production of floral perfumes would soon be at an end, as the chemical process would be sure to be cheaper than the horticultural. But nature knows how to add some touches which the chemist's art cannot imitate, and even where synthetic manufacture is possible, the result is in general regarded as a cheaper substitute. At the same time, sentimental reasons count considerably in favor of the natural perfume, and considering, further, that some perfumes cannot be imitated chemically, there is no present cause to apprehend the extinction, or, in view of increasing demand, even the decline, of the industry of producing natural perfumery oils.

The essential oils used in perfumery are secreted in different parts of the plant. The flowers are naturally thought of first, being the seat of the fragrance of the rose, violet, cassie, jasmine, tuberose, the orange in part, and numberless other plants whose perfume is extracted or only enjoyed as naturally exhaled. The oil of lavender is yielded more by the green parts of the flower-head than by the corollas. In rose geranium, thyme, wintergreen and patchouli the foliage is the fragrant part. A number of essences are derived from woods, as those of sandalwood, red cedar and rhodium. The oil of sweet birch comes partly from the wood, but mainly from the inner bark, and the same is true of sassafras. In the case of the latter, however, the roots only are used; in the case of the former the young tops. Several herbaceous roots also furnish oils, as orris root, Canada snakeroot and sweet flag. The rinds of the orange and other citrous fruits contain important perfumery oils, and the oil of bitter almonds comes from the fermented kernel of the nut.

The standard methods of extracting essential oils are four, namely, the use of mechanical means (chiefly expression), distillation, *enfleurage* or inflowering, and maceration. Expression appears to be applied only to the rinds of the citrous fruits. These are placed under pressure in a screw press, or sections turned wrong side out are squeezed in the fingers, the oil being taken up with a sponge, or the fruit is rubbed in a cup lined with spikes (*écuelle à piquer*), the oil collecting in a hollow handle. An *écuelle* on a larger scale in the shape of a hollow drum has also been used.

In distillation, the oil-bearing material is heated with water or subjected to hot steam, and the oil, being volatile, passes off with the steam. The oil would be lost if the vapor were not condensed, and this is accomplished by passing it through a coil or equivalent arrangement of pipe kept cool by a flow of water. The condensed steam and oil fall into a "Florentine recipient," a vessel with a spout coming out at the base but rising to the level of the top, so that the heavier liquid, sometimes oil, sometimes water, alone will enter it and can be poured off separately. After the water and oil have mainly separated, the water will still contain enough oil to make it highly fragrant, and in this state it goes to market as rosewater, orange-flower water, etc., or is returned to the still to be redistilled with the next charge.

The remaining two methods depend on the fact that grease has the power of absorbing essential oils. In *enfleurage* the grease, without heating, is spread over both surfaces of panes of glass which are set in frames (*châssis*), so that they can be piled one over another with spaces between. In these spaces are placed the flowers, the charge being renewed daily until the grease is sufficiently impregnated, when it constitutes a "pomade." "Extracts" are made by digesting the pomade in alcohol, which has a still stronger attraction for the perfume than has the grease. The alcohol must first be deodorized to save perverting the floral perfume, and is then known as "Cologne spirit." The grease used in this and the next process, moreover, must be freed from all corruptible matter by a special process. Tallow and lard, commonly mixed, and sometimes the fat of the deer and other animals, are employed.

In maceration the pomade is produced by immersing repeated charges of the flowers in melted grease or fine olive oil.

In recent times various chemical processes for extracting perfumery have been tried, apparently with some practical success; but they have not yet supplanted the old methods. Carbon bisulfid and petroleum ether are among the solvents employed. These methods would be less easily practiced by beginners and amateurs than the ordinary ones.

The art of distilling is not only not difficult to learn, but is already in practice in this country in the case of peppermint, sweet birch, sassafras, eucalyptus, etc. More care and better apparatus would be required for distilling roses and other flowers, but the process is essentially the same. Nor do the grease processes involve any difficulties which may not be overcome by the application of a little American ingenuity and capital. In fact, the production of the raw materials of perfumery might proceed almost at once, so far as the difficulty of the processes is concerned. But can we grow the requisite plants?

That many of the standard perfumery plants will grow in this country needs no proof, and there is no reason to doubt that their fragrance in properly chosen localities will equal that of the same plants in the European centers. In general, success in this line must be looked for only southward, even in dealing with hardy plants, though there may be exceptions to this rule. Cool trade-winds and fogs at flowering time are to be shunned. The natural conditions in Florida seem not very different from those of the south of France, the great center of perfumery farming in Europe, and in fact the feasibility of successful perfumery farming in Florida has been demonstrated by actual trial. California has also been the scene of experiments, some of them seeming to promise success as soon as economic conditions admit. A large territory between these two points is available for some lines of the industry.

Among the particular plants to be noticed, the citrous fruits deserve a leading place. Nearly or quite all of the trees of this group, including the sweet, the bitter or Seville, and the bergamot oranges, the sweet and sour limes, the lemon, the citron, and the shaddock, contain valuable perfumes either in the peel of their fruit, or in their flowers, or in their leaves, or in more than one of these. Of the fruit oils, that of lemon is imported into this country in largest quantity, followed by oil of bergamot, oil of orange bitter and sweet, oil of limes and "cedrat" or citron oil, the last two in very small quantities, but the cedrat at a very high price. These oils are extracted by expression, the distilled being inferior, though it is asserted that when the "rag," or inner soft layer, is removed, the distilled oil equals the other. The oil of the bitter orange is superior to that of the sweet; the oil of bergamot is far more valuable than either, but can rarely be had in an unadulterated state. The flowers of the orange treated by distillation yield "neroli." The scent of neroli, however,

is not that of the flowers, an alteration taking place during the distillation. Orange-flower water, consisting of the condensed vapor of water with a little unchanged oil adhering, affords the true odor of the flowers. By maceration, likewise, the true floral fragrance is obtained. The abortive flowers which fall from the trees are available for perfumery use, but the flowers are also sometimes picked, presumably with a better result. Besides the product of fruit and flowers, the leaves and young twigs pruned from the sweet and bitter oranges yield to distillation the oil of "petit grain," of considerable though minor value. There is no reason to doubt the perfumery capacity of American orange groves. Indeed it has been asserted that the orange flowers of Louisiana excel in sweetness those of foreign parts. In Los Angeles, California, something has been done towards utilizing the peel, and in Florida a beginning has been made with both peel and flowers, but for the most part these resources are at present suffered to go to waste.

The lemon verbena, *Lippia citriodora* (Fig. 1721), may be mentioned in passing as furnishing an attractive perfume of the citrous order, and as available at least in Florida and California.

The perfumery products of the rose and its allies merit next attention. The value of the importation of attar of roses—to say nothing of rose perfume in other forms—exceeds that of any single citrous perfume, and at the same time the capacity of this country for producing this and the other rose perfumes can scarcely be called in question. The present supply of the European and American markets is derived chiefly from Turkey and from the perfumery region of the south of France. The attar or otto of roses is produced most largely in Bulgaria and other parts of European Turkey, from the damask rose. It is obtained by distillation, which is there conducted in a rude manner. In the Grasse district (south of France), the rose water, obtained as explained above, yields more profit than the attar, which is regarded as a by-product of the distillation. But the rose perfume is here largely extracted by maceration, finishing with enfleurage, processes which secure the true rose odor, which is not represented by the attar or water. The pomade and its alcoholic extract are perhaps the finest of rose products. The Provence rose is here employed, a hybrid or variety of the hundred-leaf, *Rosa centifolia*, the type to which the cabbage and moss roses belong. Pictures of this rose present, not the well-known dooryard variety with short and crowded petals forming a flat disk without visible stamens, but a variety with larger and looser petals of a deeper color, with stamens in the middle. Both this and the damask rose are spring bloomers, the latter yielding also a small crop in the fall.

The luxuriance of roses on the Pacific coast and through the South invites experiments in those regions to ascertain their perfumery worth. Affluent vegetation cannot be taken as sure proof of a rich perfumery content, but this must be directly investigated by the nostrils and better by experimental distillation. There is practically no doubt, however, that in properly chosen localities American roses can compete in sweetness with the European. How far north the rose can be utilized for perfume cannot be settled in advance of experiment. The rose must have a hot sun, but the June sun is hot far to the north; and as at most only two harvests are gathered each year the advantage of the South may not be as great as might be supposed. Still the presumption is that our coming rose industry will be conducted in our warmer sections. The soil for the rose must not be poor, but there is a possibility of its being too rich for the best perfumery results. While distillation seems to be practically confined to the two roses mentioned above, other kinds whose odor is attractive are available for treatment by the grease processes. There appears to be little in the methods of cultivating roses for this purpose which would not suggest itself to an experienced gardener. It takes some 3,000 pounds of petals to yield a pound of oil, but that pound should be worth at retail about ninety dollars, and more if of extra quality.

The oil distilled from the green parts of the common rose geraniums, *Pelargonium capitatum* (?) and *P. Radula*, resembles in fragrance the oil of roses and is largely used as a substitute for it. Though generally not sold at retail under its own name, it is in itself a legitimate perfume, and its production should be undertaken in this country—only, however, in the South, where the long season admits of three crops of leaves and where the stumps with the soil heaped around them will survive the winter. The largest crop is to be had on rich lowland, but the finest quality is produced on drier and less fertile ground. In France, it is now grown mainly on irrigated land, but the product has to be ameliorated by the admixture of oil from drier locations. The rose geranium is largely grown in Algeria, and in Spain, Sicily, etc., as well as in France. Geranium oil in turn has its substitutes, among which the oil of lemon grass from India is conspicuous.

The European sweet violet, *Viola odorata*, affords the finest example of a favorite type of odors quite different from the citrine and the rose. The oil of the violet itself is necessarily so expensive as to be little used. The large amount of flowers required and the amount of hand labor necessary for gathering such small flowers, each growing on a separate stem, are apparently insurmountable obstacles to the extensive use of true oil of violet. Still it may be presumed that there will permanently be a class of buyers willing to pay the necessary cost of so choice a perfume. The violet yields its full fragrance only southward, but it must be grown in partial shade. When labor conditions admit, true violet perfume may be produced in California and in the South. An expert grower of violets has even thought that they might be grown under glass for this purpose.

Of the same general type and in some wise a substitute for violet perfume, is that of *Acacia Farnesiana*, the "cassie" of the French, known in the South as "opoponax." The small yellow balls of flowers are treated by the grease processes, particularly maceration. While not ranked as high as violet, the perfume is in entirely good standing and produced in large quantities. The flowers dried with proper care have a market value for sachets. The opoponax tree grows freely in Florida, is apparently native in Texas, and is suited to the climate of Arizona and southern California. The labor of picking the flowers would be somewhat expensive. Several other acacias are eligible for perfumery use.

To the same group belongs the perfume of orris or iris root. It is afforded by the rootstocks of three species of Iris, formerly gathered wild and now cultivated near Florence and at other points in Italy. The species are *Iris Germanica* (Fig. 1178), *I. pallida*, and *I. Florentina* (Fig. 1721), the first of these being our common garden Iris, with deep blue flowers, the second a paler-flowered species, the third having white flowers. High authority affirms that the use of the first two species is only a falsification, and in fact that the root of *I. Germanica* causes serious inflammations. It is certain that the first two are extensively grown; but *I. Florentina* alone appears to be much used for distillation. When cultivated the Iris is generally propagated by root division, the cuttings being placed for the first year in a nursery, afterward set in rows a foot apart. It is grown in stony dry soils on hillsides or mountains. The crop is gathered once in two or three years. The cuticle is scraped from the root, which after being dried in the sun is stored in a dry place for the development of its fragrance. This is wanting in the fresh root, and does not reach its maximum under three years. When distilled the root yields "orris butter," but it is more largely used in the form of an alcoholic tincture or ground up for sachets. There is no reason why orris root should not be grown in many parts of this country, but the returns at present are not large.

Another important group of perfumery plants consists of several members of the mint family. Peppermint and spearmint (Fig. 1392) can hardly be placed in the perfumery class, but lavender, thyme and rosemary could not easily be spared from the perfumer's resources. Lavender is native on dry slopes in the Mediterranean region, and the oil is most largely produced

in the region of the maritime Alps. The plant has been introduced, however, into some of the southern counties of England (Mitcham and Hitchin being the centers), and found to produce there an oil which has commonly been regarded as far superior to the French, and at any rate is different in kind (see *Mentha*). The English lavender is grown in light and well-drained calcareous soils. In well-drained ground lavender will bear some cold, especially if protected, but profit cannot be looked for far north. Lavender of the French type may be expected to succeed in California out of the reach of the trade-winds, and may perhaps not require irrigation. There are shallow calcareous soils in the "black belt" of the Gulf states which might perhaps yield an oil like the English, and the same may be true of some tracts northward on the Pacific slope. Lavender is treated by distillation, and it is said in England that direct contact with the water yields better

1721. Perfumery plants: Iris Florentina; Jasminum grandiflorum; Lippia citriodora.

results than the application of dry steam. (See, also, *Lavandula*.)

Thyme (chiefly the garden thyme, *Thymus vulgaris*) furnishes a perfume particularly suited to soaps and imported into this country in large quantities. Rosemary has a stimulating property and is an essential ingredient in Cologne water. Both of these could quite possibly be grown, say in California, but might not be able to compete well with the spontaneous product of Europe.

Some notice should be taken, too, of the rather humble group of odorous plants belonging to the parsley family, including anise, caraway and fennel. Not only are the oils of these three (chiefly anise) largely imported, but also their seeds (chiefly caraway). Caraway runs wild northerly, fennel has established itself on the lower Potomac, and anise could doubtless be grown, but there is no reason to expect large profits from these plants.

There are several plants deserving consideration which do not fall into any of these groups. One is the jasmine (*Jasminum grandiflorum* and *J. Sambac*). Fig. 1721. This furnishes almost the only odor which cannot be imitated by combinations of others. The oil of jasmine is very valuable. The plants can be grown in our warmest regions. The tuberose furnishes another choice perfume and has been very successfully grown for the purpose in Florida. (See *Polianthes*.) The heliotrope (Fig. 1032), jonquil (Fig. 1460), and mignonette are also to be named. Of a quite different scent from any of these is the oil of bitter almond, so important for fine soaps. This so-called oil is a poisonous compound formed in the process of fermenting the cake of the kernels from which the fixed oil has been expressed. Its production should be considered in our almond-growing regions, especially California.

Of our native growths there are some which are already utilized as the source of scenting materials. The root of sassafras is or has been distilled in Pennsylvania, Maryland and Virginia, and in other northern states, and sparingly southward. Wintergreen, *Gaultheria procumbens*, was formerly distilled in the North, but has given place to sweet or cherry birch, *Betula lenta*, which yields the same oil less expensively. The wood of the red cedar, *Juniperus Virginiana*, has long been distilled in Germany, and latterly in this country. It furnishes a finer cedar-of-Lebanon perfume than the cedar of Lebanon itself.

The root of the wild ginger or Canada snakeroot, *Asarum Canadense*, yields a fragrant oil quoted in market reports, and said to be used especially for strengthening other perfumes. The sweet goldenrod, *Solidago odora*, furnishes an oil which has a market standing. The rich odor of the yellow jessamine of the South has been successfully extracted in Florida. The common market perfume of magnolia is doubtless mostly or entirely an imitation, and the same is probably true of *Clethra alnifolia* perfume. The great magnolia, *Magnolia grandiflora*, abounds in the South, but its flowers might be difficult to secure in quantity. Clethra is abundant enough in the Atlantic coast region, but some difficulty might be experienced with it owing to the fact that only a part of the flowers in the raceme open at one time. The flowers of the swamp magnolia or sweet bay, *Magnolia Virginiana* or *M. glauca* (Fig. 1347), should be tried. The spice bush, *Benzoin odoriferum*, affords several scents. The sweet and copious bloom of *Azalea arborescens* in the southern mountains has been suggested for treatment. It is to be feared that the delicious odor of the native crab apples would be too expensive, considering the difficulty of collecting enough petals. The bloom of the wild grape might well be thought of. Many of our plants—these are only examples—will eventually be tried and a few will be found steadily valuable. It is useless to expect commercial success with small and scanty-flowered plants like trailing arbutus, *Epigæa repens*, however pleasing in their natural state.

The production of perfumery oils may be conducted on large farms by capitalists; or a central establishment may contract with individuals for flowers and other materials; or the business may be carried on coöperatively; or individuals may operate on a small scale in connection with other lines of farming. Some

competent women to whom other avenues are closed may find this work available and congenial.

Intending experimenters should seek further information in one or more of the books which are before the public. With regard to methods of extraction, Askinson's "Perfumes and their Preparation" may be confidently recommended. Sawer's "Odorographia" (especially the first series) is valuable both to the extractor and the grower. Piesse's "Art of Perfumery" will also be found useful on both sides of the subject. Gildemeister and Hoffman's "Volatile Oils" is also very valuable.

E. S. STEELE.

Also consult E. S. Steele's article on "Perfumery Gardening" in the Yearbook of the U. S. Dept. of Agric., for 1898. Vol. 22, part 2 of the Journal of the Royal Hort. Soc. (London, 1898) contains a list of perfumes and plants that yield them, and also a list of books on perfumes.

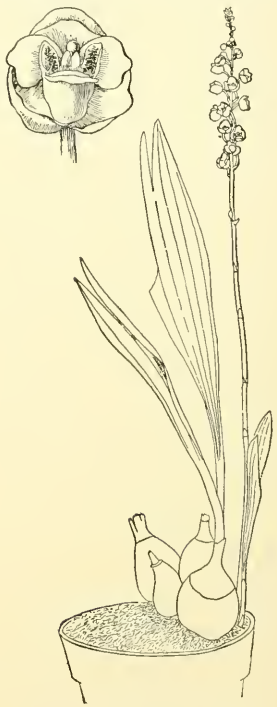
PERÍLLA (said to be a native name in India). *Labiàtæ*. *Perilla Nankinensis* is distinct among all tender bedding plants by the color of its foliage. The leaves are a dark, wine-purple, with a bronzy luster. These colors are more or less toned with green, especially in young plants. The Perilla is an annual herb, growing about 1½ ft. high. It is considerably used in subtropical beds and for the back of ribbon borders. It is sometimes planted next to a dusty miller or other white-leaved plants for the sake of contrast. The foliage has an odor suggesting cinnamon. In Japan the Perilla is of economic importance for the production of oil. Perillas need a sunny or at least half-sunny position. They thrive under the treatment given half-hardy annuals. Sow the seeds thinly and cover nearly an inch. Avoid planting Perillas too closely; leggy specimens are wretched. The fls. are inconspicuous and produced in autumn. Before the introduction of the Coleus, this plant was much used as an ornamental flower-garden plant, and is still used largely in the gardens of northern Europe, where the Coleus makes but a stunted growth. But in our warmer summers it is displaced by the more brilliantly colored and free-growing Coleus.

Perilla is placed by Bentham and Hooker next to the American genus Collinsonia, with which it agrees in the following characters: flowering calyx of 5 nearly equal teeth; fruiting calyx declinate, 2-lipped; anterior lobe of the corolla larger; perfect stamens 4. The main point of difference lies in the nutlets; those of Perilla are netted-veined, while those of Collinsonia are smooth. Also the anther cells of Collinsonia are divaricate, while those of Perilla are finally merely divergent. Perilla is placed in the same subtribe with Mentha, but belongs to a group in which the whorls of fls. are not axillary (as is usually the case in the Mentha group), but are spicate or racemose.

ocymoides, Linn. Also spelled *ocimoides*. The typical form has lvs. green on both sides and is worthless for gardens. Lvs. opposite, rarely speckled with brownish purple, only slightly wrinkled, base wedge-shaped or narrow; blade broadly ovate or roundish, pointed or blunt, hairy or not, entire or variously cut at the margin. In the wild, it is a coarse, often shaggy plant, 2–4 ft. high, with lvs. 3–6 in. long, petioles 1–3 in. long; racemes 3–8 in. long; corolla white or reddish, 2 lines long; fruiting calyx ¼ in. long. Himalayas, Burma, China, Japan. B.M. 2395.—Sparingly run wild.

Var. **Nankinensis**, Voss (*P. Nankinénsis*, Decne. *P. argùta*, Benth.). Slightly hairy, rarely glabrous; lvs. dark purple-brown, with a bronzy luster; base wedge-shaped (rounded in strong-growing specimens); blade ovate, acute, coarsely and deeply saw-toothed, margin wavy. Occasionally seedlings are green when young. R.H. 1852:60; 1879, p. 272. Forms of this variety are: (1) Var. **laciniàta** (*P. laciniàta*, Hort. Thorburn. *P. Nankinénsis fòliis atropurpùreis laciniàtis*, Hort. Benary) has lvs. cut nearly to the middle, foliage undulate, wrinkled or crisped. Colors said to be more intense. Int. about 1872. P.G. 2:77. (2) Var. **macrophýlla** (*P. Nankinénsis macrophýlla compácta*, Hort.) is a large-lvd. form characterized by its almost "bell-shaped" form. The lvs. are wavy-fringed. Habit compact. (3) Var. **elàtior** (*P. Nankinénsis macrophýlla elàtior*, Hort. Benary) is a taller form of var. *macrophylla*. (4) Var. **variegàta** (*P. Nankinénsis fòliis variegàtis*, Hort.) differs in having the foliage spotted with white. (5) Var. **microphýlla** (*P. Nankinénsis microphýlla nigricans*, Hort. Benary) is a small-lvd. form int. about 1899.

WM. SCOTT and W. M



1722. Peristeria elata—Holy Ghost Plant.
(Flower × ⅓.)

PERÍPLOCA (Greek, *peri*, around, and *plekein*, to twine; alluding to the twining habit). *Asclepiadàceæ*. Twining, rarely upright, glabrous shrubs, with opposite, deciduous or evergreen entire lvs. or sometimes leafless, and with rather small usually dark-colored fls. in axillary or terminal cymes. Most of the species are subtropical, but the only species cult. in this country is hardy north to New York, and can be grown even in Canada when trailing on the ground and somewhat protected during the winter. It is a vigorous and high-growing climber, with handsome dark green and shining foliage, and is well suited for covering arbors, trellis work and trunks of trees. It bears fragrant fls. in summer and keeps its foliage until late in fall. It thrives in any well-drained soil and prefers sunny positions. Prop. by seeds or by greenwood cuttings in summer under glass; also by layers.

Twelve species, distributed from S. Eu. to trop. Africa, China and E. India. Shrubs, with milky juice: fls. in axillary or terminal cymes; calyx 5-lobed; corolla 5-parted, bearing inside at the base a 5- or 10-lobed crown; stamens 5, with very short filaments and with

the anthers connected at the apex and villous; style short, with broad stigma: fr. consisting of 2 follicles, containing numerous, small, winged seeds.

Græca, Linn. Silk Vine. Deciduous shrub, twining to 40 ft.: lvs. petioled, ovate to oblong-lanceolate, acuminate, dark green and glossy above, 2–4 in. long: fls. in loose, long-peduncled cymes, brownish purple inside, greenish at the margin and outside, ¾–1 in. across; petals oblong, villous; crown with 5 slender thread-like incurved glabrous appendages: follicles narrow, about 4 in. long. July, Aug. S. Eu., W. Asia. B.M. 2289. B.R. 10:803. L.B.C. 14:1389. Gn. 34, p. 78. —Under the name of *P. angustifolia* a narrow-leaved form is sometimes cultivated, but it is *P. Græca*, var. *angustifolia*, Jäg. The true *P. angustifolia*, Labill., is synonymous to *P. lævigata*, Ait., from the Canary Isl. and N. Africa, with persistent lvs. and pubescent appendages of the crown. Alfred Rehder.

PERISTÈRIA (Greek, *dove*, from the form of the column and wings). *Orchidàceæ*. A genus of stately South American orchids, having large plicate leaves unfolding successively, and tall, erect or hanging flower-spikes. The flowers are nearly globose or cup-shaped, of a waxy texture, with broad, concave segments. The genus is distinguished from the related genera Acineta, Sacæna, Gongora, etc., by the curious shape of the labellum and column. The base of the labellum (hypochil) is united with the column by broad wings (pleuridia). The upper part of the labellum (epichil) is movably joined to the hypochil. Five species, of which two are commonly cultivated.

These plants are easily kept alive, but difficult to flower. When growth begins they should be planted in well-drained compost of fibrous loam, leaf-mold and sand, and carefully watered until the plants become vigorous. Later liquid manure or bone-dust may be given them in order to obtain large and vigorous flower-spikes. Liberal treatment will produce fine specimens, but poorly fed plants often fail to flower at all. When resting, they should be removed from the tropical house to a cooler room. *P. elata* is often grown as a purely terrestrial orchid.

elàta, Hook. Dove Flower. Holy Ghost Flower. Fig. 1722. Pseudobulbs 4–5 in. high, bearing several strongly veined lvs. 2–3 ft. high: fl.-stem 3–4 ft. high: fls. in a raceme covering about one-third the length of the flower-stalk, cup-shaped, creamy white, wax-like and fragrant, 2 in. across; sepals broadly ovate to rotund; petals more delicate; labellum fleshy, broadly obovate, truncate, sprinkled with deep purple; column with large, curious wings, supposed to bear resemblance to a dove, June–Sept. Panama. B.M. 3116. Gng. 5:151. V. 8:163. Gn. 12, p. 153; 30, p. 574; 42, p. 324. R.H. 1876, p. 133; 1877:110.—The labellum and wings of the column are sometimes spotted with purple.

péndula, Hook. Pseudobulbs ovate-oblong, 4–5 in. high, bearing lanceolate, strongly veined lvs.: scape pendulous, from the base of the pseudobulb, bearing as many as 20 fls.: fls. globular in outline, 1½ in. across, fragrant, greenish white outside, tinged with rose and thickly dotted with purple within; sepals roundish concave, united at base; petals rather smaller; labellum fleshy, curiously shaped, enclosed within the flower. Guiana. B.M. 3479. G.C. II. 25:116.—Requires tropical treatment, but rarely flowers in cult.

P. Húmboldtii, Lindl.=Acineta Humboldtii, Lindl.

Heinrich Hasselbring.

PERÍSTROPHE (Greek, *peri*, around, and *strophos*, belt; alluding to the involucre). *Acanthàceæ*. Erect branched or loosely creeping herbs or half-shrubby greenhouse plants cult. for their flowers. Lvs. entire: fls. solitary or in clusters of 2–3 surrounded by an involucre, in loose cymes or cymose panicles, or distant on slender branches; bracts of the involucre narrow; calyx deeply 5-parted, shorter than the bracts, scarlose or hyaline; corolla-tube long, slender, slightly enlarged above, limb deeply bilabiate, the posterior lip narrow, erect, concave, entire or emarginate, lower lip spreading, apex 3-parted; stamens 2, a little shorter than the corolla lips; anthers 2-celled; sterile stamens none; style filiform: capsule oblong, contracted into a solid stalk. About 15 species, ranging from tropical Africa through the Malay Islands and Australia to India.

The plants are cult. like Jacobinias or Justicias, of the same family. Cuttings taken at any time when the wood is soft will root in a warm bed in 3–4 weeks, after which the potted plants may be removed to a house of lower temperature. They require a rich loam mixed with some leaf-mold, and plenty of air.

1723. Peristrophe speciosa (× ½).

speciòsa, Nees (*Justícia speciòsa*, Roxb.). Fig. 1723. Plants erect, spreading and branched, becoming 2–3 ft. high: lvs. opposite, petioled, ovate-acuminate, smooth: fls. in clusters of 2–3 on slender branches, violet-purple, 1¾ in. long. Fls. for a long period in winter. India. B.M. 2722. L.B.C. 20:1915. B. 2:74.—A pot-plant of bushy, compact habit when well grown. Good for the window. Usually thrives best in partial shade.

angustifòlia, Nees. Plants low, erect, very much branched: branches nearly horizontal, pubescent above: lvs. lanceolate, pointed at both ends: fls. sparse, in terminal cymes, rose-colored. Flowers freely. Java.—A var. **aùrea variegàta** has the center of the lvs. variegated with yellow. Useful for vases and baskets.

Heinrich Hasselbring.

PERIWINKLE. *Vinca.*

PERNÉTTYA (after A. J. Pernetty (1716–1801); he accompanied Bougainville on his voyage and wrote "A Voyage to the Falkland Islands"). *Ericàceæ*. Ornamental low evergreen shrubs, with small, alternate, usually serrate lvs. and small, white or pinkish, nodding fls., usually solitary in the axils and followed by very decorative berries varying in color from white to purplish black or bluish black and remaining on the branches all winter. These exceedingly pretty shrubs are great favorites in England, but are little known in this country. *P. mucronata* and *P. angustifolia*, the hardiest, are probably hardy in sheltered positions as far north as New York. They are well suited for rockeries and borders of evergreen shrubberies and also make very handsome pot-plants. They grow best in a peaty and porous moderately moist soil and prefer sunny positions, but seem to grow almost as well in any other well-drained soil; in shade they will not fruit as profusely as in the full sun. Prop. by seeds or by cuttings of half-ripened

wood in summer under glass; also by means of layers and suckers. Grown chiefly for the ornamental fruit.

About 25 species from Mexico to the Magellan region, mostly in the mountains and 1 species in Tasmania and New Zealand. Fls. axillary, usually solitary on slender nodding pedicels, rarely in racemes; calyx 5-parted; corolla urceolate, with short 5-lobed limb; stamens 10, the authers 4-awned at the apex: fr. a 5-celled many-seeded berry. Allied to Gaultheria, but the calyx not enlarged and rarely fleshy after flowering.

mucronàta, Gaudich. (*Arbutus mucronàtus*, Linn. f.). Much-branched shrub, to 2 ft., with glabrous or sparingly hairy branches: lvs. almost two-ranked, ovate, spiny-pointed, serrate, dark green and shining above, glabrous, ½–¾ in. long: fls. solitary, nodding, subglobose, white or slightly tinged pink, about one-fifth in. long: fr. white to dark purple, ½–¼ in. across, red in the typical form. May, June. Magellan region to Chile. B.M. 3093. B.R. 20:1695. L.B.C. 19:1848. Gn. 23:389; 59, p. 41. Gt. 34, p. 214. G.M. 40:811. M.D.G. 1898:397. —Many vars. partly originated by hybridizing with the following species are cult. in English and Dutch nurseries, mostly differing in the color of the fr., which is usually indicated by the name of the var., as, var. **álba, atropurpùrea, coccínea** (F.M. 1879:339), **lilacína** (F.M. 1879:339), **nígra, purpùrea** (F.M. 1879:339), **rósea, sanguínea.** Also *P. Drummondi, Cummingi, speciosa, floribunda* (G.C. II. 18:649 and III. 28:465), belong here. *P. mucronata* and its vars. are among our most ornamental fruiting shrubs in winter-time, when they are loaded with bright-colored berries contrasting well with the dark glossy foliage; they are also very handsome in spring when covered with their numerous white flowers.

angustifólia, Lindl. (*P. mucronàta*, var. *angustifólia*, Nichols.). Closely allied to the preceding: lvs. lanceolate to linear-lanceolate, usually arched backwards, smaller: fls. somewhat smaller, on slender pedicels; anthers twice as long as filaments; style as long as ovary. May, June. Chile. B.R. 26:63. B.M. 3889.

P. ciliàris Don. Spreading shrub: lvs. oblong to narrow-oblong, serrulate, ½–1 in. long: fls. solitary, ovate, white: fr. almost black. Mexico.—*P. ciliàris*, Lindl. G.C. II. 16:89, and III. 28:463, belongs probably to *P. furens.*—*P. furens*, Klotzsch. Upright shrub: lvs. ovate to ovate-lanceolate, ciliate, to 1½ in. long: fls. in axillary, secund, rather dense racemes: fr. brownish red. Peru, Chile. B.M. 4920.—*P. Péntlandii*, DC. Similar to P. mucronata, but lvs. not spiny-tipped: fr. dark purplish blue, with the calyx-lobes fleshy. Venez. to Chile. B.M. 6204.—*P. phillyreæfólia*, DC. Similar to P. mucronata: branches sparingly hispid: corolla ovate, pubescent inside; anthers twice as long as filaments. Peru, Chile.—*P. pilósa*, Don (Arbutus pilosa, Grah.). Prostrate shrub, with densely hispid branches: lvs. elliptic-oblong, serrate, to ¾ in. long: fls. ovate, white, solitary. Mexico. B.M. 3177.

ALFRED REHDER.

PEROTTIA of a trade catalogue is an error for *Parrotia*.

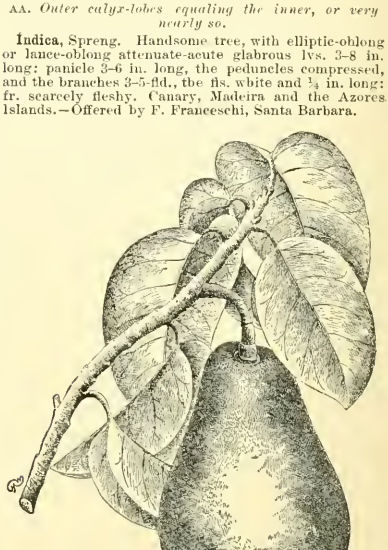
PERSÈA (pre-Linnæan name, ultimately derived from Persia). *Laurâceæ*. As understood by Bentham & Hooker, Persea contains about 100 species, but Meissner (DC. Prodr. 15, pt. 1, 43) distributes some of the species in other genera, and retains only 50 in Persea. The Perseas are trees or shrubs of the tropics or warm-temperate parts of America and the Old World, with thick alternate leaves and small white or greenish flowers, mostly in panicled fascicles; the flowers are usually perfect, with deeply 6-parted calyx, no corolla, and stamens usually 12 in 4 series, but one series sterile. The pistil is single, the ovary being sessile and tapering into a style which bears a disk-like stigma. Three species are in the American trade, all being prized for their clean evergreen foliage, and one of them, *P. gratissima*, for its large edible fruit. *P. Carolinensis* grows naturally as far north as North Carolina, and *P. Catesbyana*, a shrubby species which is not in the trade, grows naturally in south Florida.

A. *Outer calyx-lobes distinctly shorter than the inner.*

Carolinénsis, Nees. RED BAY. BULL BAY. Tree, reaching 40 ft., with smoothish branches: lvs. 2–3 in. long, oblong to lance-oblong, glabrous and deep green above, glaucous beneath: fls. pubescent, the peduncles of the clusters shorter than the petioles: fr. a small, blue drupe. Woods, N. Car. to Fla.—A handsome evergreen, with wood useful for cabinet work and other purposes.

AA. *Outer calyx-lobes equaling the inner, or very nearly so.*

Índica, Spreng. Handsome tree, with elliptic-oblong or lance-oblong attenuate-acute glabrous lvs. 3–8 in. long: panicle 3–6 in. long, the peduncles compressed, and the branches 3–5-fld., the fls. white and ¼ in. long: fr. scarcely fleshy. Canary, Madeira and the Azores Islands.—Offered by F. Franceschi, Santa Barbara.



1724. Alligator Pear. Persea gratissima (×⅛).

gratíssima, Gaertn. f. ALLIGATOR PEAR. AVOCADO PEAR. AQUACATE. MIDSHIPMAN'S BUTTER. Fig. 1724. Native to the American tropics, but now widely distributed: fls. greenish, downy, in dense fascicles which are arranged in leafless panicles: ovary downy, ripening into a large pear-shaped, green or purplish drupe, containing one large seed. B.M. 4580. B.R. 15:1258. I.H. 36:75.—Offered in southern Florida and southern California. The fruit is occasionally seen in northern markets. In Southern California and Mexico the fruit is common in the markets. It is grown to a small extent as far north as Los Angeles, but it requires a hotter climate to render the fruit certain and palatable. It will thrive in climates to which Anonas are adapted.

L. H. B.

The Avocado, or Alligator Pear, is a native of the West Indies, Mexico to Peru and Brazil. It is very common in Jamaica, being found in every settlement or plantation. The tree grows to a height of 25 to 30 ft.; it has elliptical or elliptical-oblong leaves, 4–7 in. long, glabrate and pale beneath; the fruits are large, more or less pear-shaped, and covered with a green or deep purple skin, and containing a large quantity of a firm, yellowish green pulp, enclosing a single large seed. This fruit is highly esteemed by all classes in the West Indies. The pulp is marrow-like, and is eaten as a salad, usually with the addition of pepper, salt and vinegar. Europeans as a rule do not like the fruit at first, but once the taste is acquired they become exceedingly, often excessively, fond of it. The pulp contains an abundance of oil which may be used for illu-

minating purposes, also for soap-making. The seeds yield a deep, indelible black stain, and are used for marking linen. Plants are easily raised from seeds, and in good soil in warm situations they grow rapidly, and begin to fruit when about five years old. There are a good many varieties, differing from each other in size, shape and quality of fruit. These differences are not due to careful cultivation and selection in all cases, however, but to natural variation and accidental intercrossing.

W. HARRIS.

PERSIAN INSECT POWDER. *Chrysanthemum*, p. 312.

PÉRSICA. See *Prunus*.

PERSICÀRIA. Referred to *Polygonum*.

PERSIMMON. Plate XXVIII. Of the Persimmon, two types are known in cultivation for their fruit,—the native, and the Japanese or Kaki. The former is yet little improved, although it has possibilities. See *Diospyros*.

The native Persimmon or date plum, *Diospyros Virginiana* (Fig. 1725), is found growing wild in most of the southern states and as far north as 38° lat. It will thrive and ripen its fruit, however, as far north as the Great Lakes. The fruit is little known except to those who live in localities in which it grows wild, and even there but little attention has been given to its cultivation and improvement. The tree is usually of small size when grown in the open ground, reaching a height of 20–30 ft.; when grown in the forest it often reaches a height of 60–80 ft.; and in the rich alluvial river bottoms, from 2–3 ft. in diam. The wood is hard and elastic, and very durable when used for inside work, but it will rot very quickly when placed under ground. The fruit is subglobose and ranges in size from ½–2 in. in diam., depending largely on the number of seeds which it contains, although seedless varieties an inch in diameter are sometimes found. The fruit has a very disagreeable, astringent quality when green, but this disappears in most varieties when it becomes fully ripe. The date of ripening in the central states varies from Aug. 1 to Dec. 1. The old notion of early botanists that this fruit must be subjected to the action of frost before it becomes edible is erroneous; many of the very best varieties ripen long before the appearance of frost, while others never become edible, being so exceedingly astringent that neither sun nor frost has any appreciable effect on them. The Persimmon is readily propagated from seeds, which should be procured in the fall or early winter and planted in the same manner as peach pits; but as the seedlings, especially from cultivated varieties, cannot be relied upon to reproduce themselves, they should be budded or grafted when 2 or 3 years old. This should be done in the spring as soon as the bark will slip freely. This tree is more difficult to transplant successfully than almost any other kind of fruit. If too much of the long tap-root is cut off the tree will be sure to die. Transplant in the autumn, cut back most of the top, but preserve as much of the root as possible. The Persimmon will do fairly well on almost any kind of soil not too wet, but it will show its appreciation if planted on a rich, warm soil, well exposed to the sunlight, and kept well cultivated for the first few years after planting, until it becomes adapted to its new surroundings.

J. TROOP.

The Japanese Persimmon, Diospyros Kaki, is considered by the Japanese as their best native pomological product. Although cultivated in the south of France for more than 75 years, there is no record of its successful introduction into the United States previous to about 1870. Trees were first sent to California and subsequently to Augusta, Ga., but owing to defective roots and long delay in transit, the first and second shipments proved a failure, and not until 1876 came the first success with a few trees. All early importations of trees grown in Japan consisted of trees of small sizes with long tap-roots and no laterals; this, with imperfect packing, caused their loss and subsequent disappointment. American enterprise, however, remedied this, as nurseries were at once established near Yokohama and well-grown trees of the best varieties were exported to the United States. Experiments were made at the South by grafting upon native stocks. This proved successful when the graft was inserted upon the collar of the root, 3 to 4 inches below the surface of the soil; but top-grafting or budding upon side branches of large trees was seldom free from failure. The best method of propagating Japan Persimmons is by collar-grafting upon seedlings of the native species (*Diospyros Virginiana*), which are grown either by planting the seed in nursery rows or transplanting the young seedlings from seed-beds early in the spring. The seedlings can be budded during summer, and in favorable seasons a fair proportion of the buds will succeed.

The U. S. Department of Agricultnre received a large quantity of trees from Japan about 1878 or 1879, and fearing that the winter of Washington might prove too cold the trees were sent to Norfolk, Va., where many bore fruit the following year. The first fruiting of which there is any record was at Augusta, Ga., in 1879, upon trees grafted upon native seedlings growing in the forest. As regards the hardiness of the Japanese Persimmons, an experience of twenty-five years demonstrates that some varieties are more resistant to excessive cold than others; but few can withstand a temperature of zero; and as a rule they are more successful below the 32d degree of latitude than farther north. Many seedlings have been produced that seem to have increased frost-resisting powers. Instances are reported in which some of these trees have withstood the winters of east Tennessee. By successive sowing of seeds from these hardier seedlings we may look for a race of trees, either of pure Japanese blood or crosses with our best native sorts, that will be adapted to the middle sections of the U. S., or as far north as is the habitat of the American species.

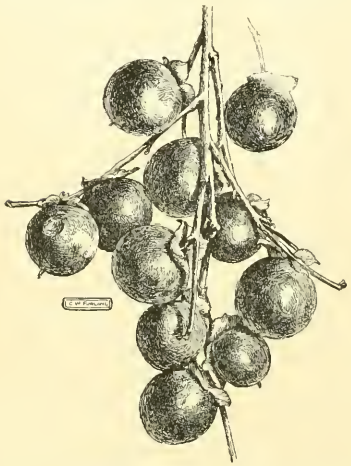
Seedlings, so far as proved by many experimenters, have a tendency to produce male flowers only during the first three years of blossoming. After that period a few female flowers appear in very small proportion, sometimes one female flower to 200 male flowers. Fully one-half of the seedlings produce nothing but male flowers; consequently the proportion of fertile trees is seldom more than 2 to 5 per cent at first blossoming, in cases in which subsequent female flowers appear not above 10 per cent. Again a large proportion of the fruit is small, austere and uneatable. This accounts for the small list of the really good sorts cultivated in Japan or exported here.

There is a great difference in the habit of growth and foliage of the varieties. All have broad and shiny leaves. Some varieties make a growth of 5–7 feet the first year from graft, and at 10 years form a tree 10 ft. in height. Others assume a dwarf, compact habit and seldom grow above 5–6 ft. in height; this class is more precocious in reaching the bearing age than the taller-growing sorts, which are also apt to overbear. It is not uncommon for a three-year-old tree to yield several hundred perfect fruits. Thinning the fruit as soon as set in early summer will prevent an early demise of the tree. Trees thrive in any soil in which the native species grow, but usually fail in wet soils.

The fruit of all the varieties is very attractive, both as to size and color. The latter is usnally of a bright orange-red or vermilion, which is more or less intensified according to variety. The fruits begin to color when half grown, but should not be gathered until just before frost for the late-ripening varieties, or until soft with the early kinds. Some varieties begin to ripen in the middle South as early as September, but a part of the crop upon the same tree can be left to hang until frost and kept sound in a cool room until January. The round-shaped varieties ripen first, the oblong last and keep the longest; these latter should be slowly house-ripened to remove the slight astringency inherent to these varieties.

The flesh varies according to varieties, but is usually of a bright orange color, soft, rich and sweet and with an apricot flavor; when soft, the pulp should be eaten with a spoon. Some varieties have dark brown-red flesh, and are usually edible when quite solid. A peculiarity of these consists in both red or half red- and half brown-fleshed specimens being produced upon the same tree.

This is frequently the case when several varieties are grown near each other, possibly showing the effect of cross-pollination. This variation in the color of the flesh has caused some confusion in reaching a correct nomenclature. The earlier shipments of trees from Japan usually consisted of about 12 names, but no reliance could be placed upon these names. The same name was often found to apply to several distinct varieties, or one variety had several synonyms. After years of fruiting the so-called 40 varieties originally



1725. The native Persimmon, Diospyros Virginiana (× ⅓).

introduced, a more or less correct nomenclature has been attempted; but from the many local names found in various localities this has been a difficult task.

In the annexed list of the most desirable varieties such synonyms are added thereto as have been ascertained after several years' trial. Many names refer to Japanese localities, others to their shape, size, color, etc.; their significance in Japanese has as far as possible been translated in English by Mr. Irata, a highly educated Japanese artist, to whom the writer is also indebted for valuable information as to the use of this fruit in his native country.

Amongi, or *Yemon* (name of a Japanese ornament).—Round, flattened, deeply ribbed, dark orange-red, and sometimes yellowish red, 2½–3 in. in diam.; average weight 6 ounces, and occasionally a specimen weighing 16 ounces is produced. Very sweet; flesh red and edible while still solid; quality improves as it becomes soft. Maturity Sept. to end of Nov. Tree of moderate height.

Hachiya ("Beehive" in Japanese).—Synonyms, Costata, Imperial, Yomato, etc. Oblong, with blunt apex, slightly ribbed, 2½ by 3 in.; average weight 5 ounces. Flesh deep orange-red, astringent while solid, but sweet and very good when soft. Should be house-ripened, and can be kept until March. Tree of vigorous and tall growth. This variety is usually dried in the manner of Smyrna figs and is of excellent quality; is often exported in the dried state.

Hiyakume or *Hyakume* (one hundred "me," a unit of Japanese weight). Plate XXVIII.—This is perhaps the most desirable of the round, red-fleshed varieties and as the fruit affects various shapes, it is known under many names, such as Pound, Tane-nashi, or Seedless, etc. The Agricultural Bureau of Tokio gives the latter name to a variety with black mottled apex, but we find both round and elongated forms upon the same tree, as also uniformly orange and orange-yellow colored specimens, while many are heavily tipped with black. The variation of forms and colors doubtless led to its array of synonyms. Fruit large, averaging 3 inches in diam., and 5 ounces in weight; usually flattened, but elongated forms are quite common upon the same branch. Flesh bright orange-red. Keeps very late. Must be soft before being edible. Tree of moderate height; apt to be of dwarf growth. Sometimes seedless, but frequently with from 6 to 8 seeds.

Isyama Gaki (name of locality).—Medium to large, round, but somewhat narrower at the apex, yellowish orange, with dark or black pencilings at apex. Flesh dark brown or grayish brown; very sweet. Can be eaten when solid; 4 to 6 ounces.

Kurokume (this may possibly be *Goshio-hira*, or Palace Persimmon).—Very large, round, somewhat flattened; 3 to 3½ in. in diam.; average weight 10 ounces, and sometimes yields specimens 16 ounces in weight; keeps late. Flesh red. Tree erect grower.

Minokaki (Persimmon from Mino, name of a locality).—Synonym, Large Stork Egg. Large to very large, oblong, pointed, frequently weighing 10 to 12 ounces; skin bright vermilion-red; flesh red, rich but astringent unless softened by house-ripening. The foliage is very long, narrow and distinct from any other variety. Immensely productive, a 6-year-old tree having produced upwards of 500 specimens. Usually prepared in Japan for winter use by being placed in a closed barrel until the astringency is removed. Also valuable for drying.

Miyo-tan (Mazelli).—Plate XXVIII. Round or slightly oblong, 2½ in. diam.; average weight, 5½ ounces; slightly ribbed; deep orange-red; flesh usually deep brown-red, but bright red- or half red- and half brown-fleshed specimens are often produced upon the same tree, the results of cross-fertilization by other varieties. Tree of medium or dwarf growth; exceedingly prolific. Fruit keeps very late. The brown-fleshed specimens are edible while solid, and as early as October 1.

Okame ("Stout young girl" in Japanese).—Synonyms, Oblong Hyakume, Mikado, etc. Medium to large, 2½ x 3½ in., oblong, deep red, nearly always seedless; keeps late.

Tsuru-no-ko ("Stork Egg").—Plate XXVIII. Large, oblong, pointed, 2½ x 3½ in.; weight 4–5 ounces, sometimes 10 ounces; skin bright red; some specimens covered with black at apex; flesh red, very good. Keeps late; edible only when soft. Foliage long and shiny; tree compact and vigorous grower. This variety varies very much as to size at different seasons.

Yedo-Ichi (also written "Yeddo-Ichi No. 1," or "best in Yedo," latter being the old name of Tokio).—Syn., Maru-Gata ("round shape"). Medium, round, some specimens slightly oblong, flattened at base and narrowing at apex; skin dark red, often with black mottlings near apex; flesh mahogany brown, with darker spots, brittle, and is edible while solid as early as Oct. 1. Very prolific, and bears fruit in large clusters. Tree an upright grower.

Zengi, or *Zingi* (name of Japanese village).—Plate XXVIII. Small, 1¾ x 2 in.; weight 3 to 4 ounces; flesh dark brown, with darker spots; very sweet; edible as early as middle of September while still solid, and lasts throughout October.

P. J. Berckmans.

Another Estimate of the Japanese Persimmons.—Grafted on our native Persimmon, *Diospyros Virginiana*, the Japanese varieties seem perfectly at home and make much longer-lived trees than those imported from Japan. All varieties come into early bearing and many of them are too prolific for the best welfare of the trees. This tendeney to overbear should be corrected by thinning the fruit. Several of the varieties produce very large fruit, single specimens often weighing over a pound.

Some of the varieties ripen in August, some in November, and others intermediate between these dates. It requires some experience to determine just when the fruit has reached the proper stage to be marketed, and this varies with the different varieties. Some of the varieties have dark flesh, others light flesh, still others a mixture of the two. The light and dark flesh differ radically in texture and consistency, as well as appearance, and when found in the same fruit are never blended, but always distinct. The dark flesh is never astringent; the light flesh is astringent until it softens. The dark-fleshed fruit is crisp and meaty, like an apple, and is edible before it matures. Some of the entirely dark-fleshed kinds improve as they soften. The light-fleshed kinds, and those with mixed light and dark flesh, are very delicious when they reach the custard-like consistency of full ripeness. In some, the astringency disappears as the fruit begins to soften; in others it persists until the fruit is fully ripe. Seeds accompany the dark flesh. The light-fleshed kinds are seedless. The kinds with mixed flesh have seeds in proportion to the quantity of dark flesh.

The market value of the fruit is at present more or less erratic. A large proportion of the fruit-eating people of the North do not yet know what a fine fruit the Japanese Persimmon is. The fruits have to be shipped while hard and allowed to ripen after reaching destination. Commission men are likely to sell them and the public to eat them—or attempt to do so—a week or two ahead of the proper stage of ripeness; hence the

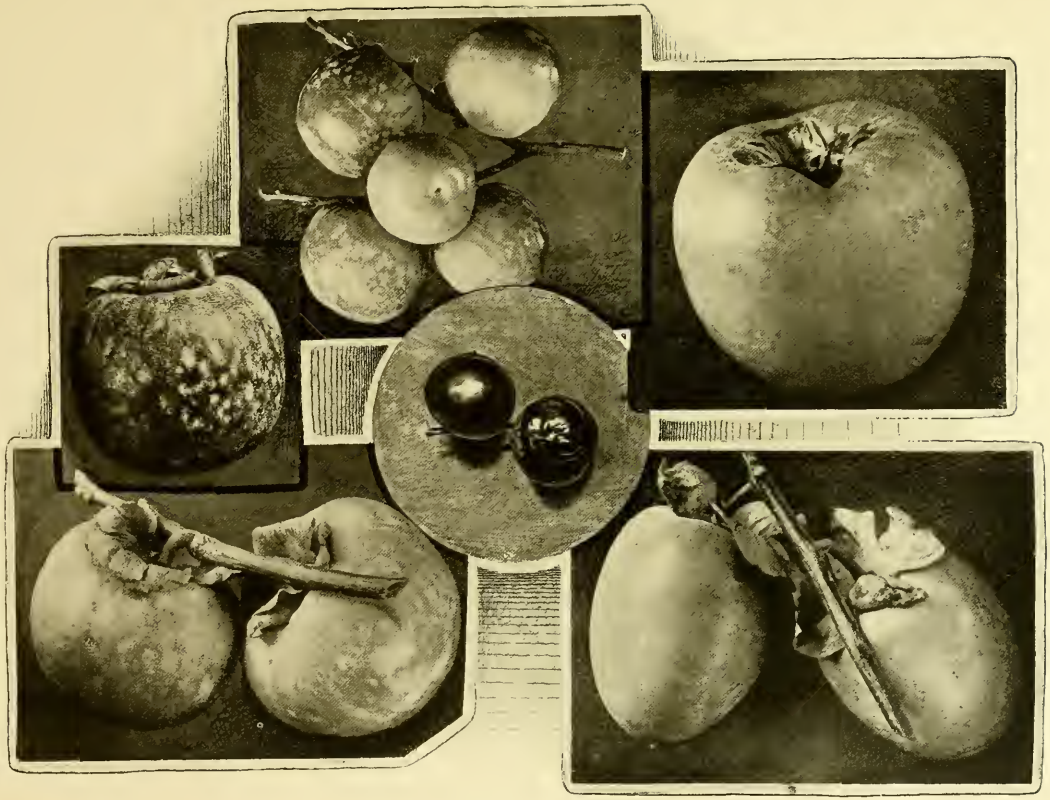


Plate XXVIII. Persimmons

Center, native Persimmons, *Diospyros Virginiana*. The others are the Kaki or Japanese Persimmon; top, Zengi; left, Miyo-tan; lower left-hand corner, Hiyakume; lower right, Tsuro-no-ko; upper right, Tane-nashi. All one-half natural size

Japan Persimmon in its best conditiou is comparatively little known.

The following are some of the most prominent varieties (as understood by the writer) arranged in order of ripening, beginning with the earliest; although it must be borne in mind that some of the varieties are more or less interchangeable, in different seasons.

Zengi.—The smallest of all; round or roundish oblate; diameter 1¾ in. longitudinally and 2¼ in. transversely; skin yellowish red; flesh very dark, quality good; seedy; edible when still hard; one of the earliest to ripen. Vigorous, prolific.

Taber No. 129.—Medium, roundish, flattened at base; has a small but well-defined point at the apex; diam. about 2½ in. both ways; skin dark yellow-red, with peculiar roughened surface, somewhat resembling alligator leather in appearance and markings, except that the marks are usually very small and uniform; flesh light brown, crisp, sweet, meaty, free from astringency; excellent; a good keeper and shipper.

Yeddo-Ichi.—Large, oblate; diameter 2½ in. longitudinally and 3 in. transversely; very smooth and regular in outline, with diuted appearing surface and slight depression at end opposite the stem; skin darker red than most varieties, with heavy bloom; flesh very dark brown, verging toward purplish; sweet, rich, crisp; in quality one of the best. The fruit is good to eat when still hard. A heavy bearer and exceedingly thrifty.

Hyakume.—Large to very large, varying from roundish oblong to roundish oblate, but always somewhat flattened at both ends; generally slightly depressed at the point opposite the stem; diameter 2¼ in. longitudinally and 3¼ in. transversely; skin light huffish yellow, nearly always marked with rings and veins at the apex; flesh dark brown, sweet, crisp and meaty, not astringent; good while still hard; a good keeper; one of the best market sorts. Of good growth and a free bearer.

Yemon.—Large, flat, tomato-shaped, somewhat four-sided; diam. 2¼ in. longitudinally and 3¼ in. transversely; skin light yellow, changing to dull red, mottled with orange-yellow; distinct in color; flesh deep, dull red, brown around the seeds, of which there are usually a few; some specimens are entirely light-fleshed and seedless; there is no astringency after the fruit begins to soften; quality fine; one of the best. In form some of the fruits have the corrugations converging to the depressed apex, as it is usually figured, but most do not.

Hachiya.—Very large, oblong, conical, with short point; very showy; diameter 3¾ in. longitudinally and 3¼ in. transversely; skin dark, bright red, with occasional dark spots or blotches and rings at the apex; flesh deep yellow, sometimes having occasional dark streaks, with seed. Astringent until ripe, then very fine. The largest and handsomest of all. Tree vigorous and shapely; bears fairly well, but is not as prolific as some of the other varieties.

Taber No. 23.—Medium, oblate, flat or depressed point; diam. 1⅝ in. longitudinally and 2⅜ in. transversely; skin rather dark red, with peculiar stipple marks; flesh dark brown, sweet and not astringent; seedy; good. Prolific.

Tane-Nashi.—Large to very large, roundish conical, pointed, very smooth and symmetrical; diam. 3¼ in. longitudinally and 3⅜ in. transversely; skin light yellow, changing to bright red at full maturity; flesh yellow and seedless; quality very fine; perhaps the most highly esteemed of the light-fleshed kinds. Tree is vigorous and bears well.

Okame.—Large, roundish oblate, with well-defined quarter marks, point not depressed; diameter 2⅜ in. longitudinally and 3⅛ in. transversely; skin orange-yellow, changing to brilliant carmine, with delicate bloom and waxy, translucent appearance; the most beautiful of all; light, clear flesh when ripe, with light brown center around the seeds, of which it has several; loses its astringency as soon as it begins to ripen; quality fine. Tree vigorous and good bearer.

Triumph.—Medium; tomato-shaped; skin yellow; flesh yellow; generally has a few seeds; very productive; quality of the best. Ripens from Sept. till Nov.

Tsuru.—Large, slender, pointed; longest in proportion to its size of all; diam. 3⅛ in. longitudinally and 2⅝ in. transversely; skin bright red; flesh orange-yellow, some dark flesh around the very few seeds; astringent until fully ripe, then good.

Costata.—Medium size, conical, pointed, somewhat four-sided; diam. 2¼ in. longitudinally and 2⅜ in. transversely; skin salmon-yellow; flesh light yellow, dark flesh and seeds occurring seldom; astringent until ripe, then very fine; a good keeper. Tree distinct; a rapid, upright grower; foliage luxuriant; the most ornamental of all the varieties mentioned.

G. L. Taber.

PERU, MARVEL OF. *Mirabilis Jalapa.*

PERUVIAN BARK. *Cinchona.*

PESCATÒRIA (after M. Pescatore, who had a large collection of orchids at St. Cloud, near Paris). *Orchidàceæ.* A group often united with Zygopetalum, but in horticultural works usually treated as a distinct genus. The lvs. are equitant, tufted, without pseudobulbs; fls. solitary on stems 3–6 in. long, from the axils of the lvs., mostly large and showy, aud fragrant; sepals and petals broad, concave, spreading; the lateral sepals forming a mentum; labellum clawed, lateral lobes small, middle lobe rounded, spreading; crest thick, consisting of a number of keels arranged in a semi-circle near the base of the lip; column slender, not boat-shaped. About 10 species. For culture, see *Zygopetalum.*

Klabochòrum, Reichb. f. Lvs. strap-shaped, 1 ft. or more long; fls. 3–3½ in. across, variable in color; sepals oblong, obtuse; petals shorter, all white with chocolate-purple points; labellum 3-lobed, yellowish or white, and having many purple-tipped hairs; callus sulfur-colored, with brown keels. Ecuador. Gu. 22:344.

Dayàna, Reichb. f. Lvs. tufted, 6–10 in. long; fls. on short scapes; sepals oblong-obovate, acute, white, with green tips; petals rhomboid-rotund; labellum clawed, angled on each side of the base; limb oblong, emarginate, revolute on the sides, white with a callous ring which is purple-violet, the base being of the same color; column yellow, with a red band near the base and the anther of the same color. Late autumn. Colombia. Var. **rhodàcra,** Reichb. f. Sepals and petals with rose tips; labellum orbicular, suffused crimson. B.M. 6214.

cerìna, Reichb. f. Lvs. in tufts of 4 or 5, cuneate-oblong, pointed, 1 ft. long; peduncles 2–6 in. long, 1-fld.; sepals and petals nearly equal, the latter somewhat clawed, fleshy, rounded, concave, pale straw color; labellum ovate, yellow, with a thick semicircular crest. Flowers at various seasons, the fls. lasting a long time. Chiriqui. B.M. 5598 (as *Huntleya cerina*). F.S. 17:1815 (as *Zygopetalum cerinum*).

Heinrich Hasselbring.

PETALOSTÈMON (named from the peculiar relation of the petals and stameus). *Leguminòsæ.* About 22 species of American herbs, mostly western and perennial, glandular-dotted, with small odd-pinnate lfts. and spikes which are terminal or opposite the lvs., and bear many small fls. ranging from white through rose to purple and violet. *P. violàceus* is a charming plant, thriving in any light soil and forming a broad, low bush with finely cut foliage, and bearing a constant succession of showy spikes of deep violet flowers. Well adapted for the front of the border or the rockwork.

Petalostemon and Dalea are characterized by having the lower petals longer than the standard, with their claws adnate to the staminal tube; but Petalostemon has only 5 stamens, while Dalea has 9–10. Other generic characters: calyx-teeth or lobes about equal: standard cordate or oblong, with a free, slender claw, the 4 lower petals distinct and subsimilar: ovary sessile, 2-ovuled: pod included by the calyx, membranous, usually indehiscent and 1-seeded.

A. *Fls. white.*

cándidus, Michx. White Prairie Clover. Height 1–2 ft.: lfts. 5–9, oblong or oblanceolate, 8–12 lines long. Ind. to N. W. Terr., south to La. and Tex. B.B. 2:289.

AA. *Fls. rosy purple or violet.*

B. *Habit decumbent.*

decúmbens, Nutt. Stem about 1 ft. long: lfts. 7–9, linear-oblong: fls. deep violet-purple. Red River, Ark.

BB. *Habit erect.*

C. *Bracts glabrous.*

violàceus, Michx. Violet Prairie Clover. Height 1½–3 ft.: lfts. 3–5, narrowly linear, often mucronate at apex: fls. violet or purple; corolla about 2 lines long. Prairies, Ind. to Texas. B.B. 2:290. B.M. 1707.

CC. *Bracts silky-pubescent.*

tenuifòlius, Gray. Silky Prairie Clover. Height 1–2 ft.: lfts. 3–5, linear, obtuse at apex: fls. rose-purple. Dry soil, Kans. to New Mex. B.B. 2:291.

J. W. Manning and W. M.

PETASÍTES (Greek, *a broad-brimmed hat;* referring to the large, broad lvs.). *Compósitæ.* About 8–12 species of hardy perennial herbs much like the common coltsfoot (*Tussilago Farfara*), having large lvs. of the same general shape and more or less covered with the same white felt, but the fls. range from purple to white, not yellow, and are borne in corymbs instead of

singly. They are rather coarse and weedy, but the following are desirable for special purposes.

P. fragrans, the Winter Heliotrope or Sweet Coltsfoot, has the merit of blooming in winter and its fls. have a delightful vanilla-like odor. The fls. are small and vary from pale lilac to purple. A few sprays are desirable for cutting during winter. The plant also differs from the common coltsfoot in having darker colored and evergreen foliage. It is suitable for carpeting shrubberies and for dry banks of stiff clay where choicer subjects will not thrive. Like most others of the genus, it spreads rapidly by underground runners. This plant seems to be unknown to American commerce; the above points being taken from Gn. 23, p. 113, and 53, p. 328, where the plant is well pictured.

P. palmata blooms from April to June, its fls. varying from nearly white to pale blue or purplish. It is found in rich dark swamps or sphagnum bogs from Newfoundland to Alaska and south to N. Y., Wis. and Calif. It has been offered by two dealers in native plants.

P. Japonica, var. *gigantea* has recently appeared in European and American garden literature. The catalogue of the Yokohama Nursery Company states that the leaf-stalks grew 6 ft. high and 1–1½ in. thick. The stalks are eaten as a vegetable after being boiled, and are also preserved in salt or sugar. The flower-buds, which appear in February, are used as a condiment, as they have a slightly bitter but agreeable flavor. The plant has been advertised in America since 1900 by several dealers.

The genus is widely distributed in north temperate and subarctic regions. The number of species is uncertain, but the essential character of the genus (as distinguished from Tussilago) is that the heads are nearly or quite dioecious, and rayless or with very short and not showy rays; also the fact that the scapes usually have many fls. instead of one. The lvs. are orbicular or reniform, always with a deep heart-shaped base and the scapes are covered with scales like a coltsfoot but sometimes the lower ones are more leafy.

A. *Size of lvs. gigantic, 3½–4 ft. across.*

Japónica, F. W. Schmidt. Island of Sachaline. Var. **gigantèa,** Hort. Lvs. orbicular, margin wavy. Sachaline Isl.—Grows as high as a man.

AA. *Size of lvs. 3–12 in.*

B. *Blooming December to March.*

fràgrans, Presl. WINTER HELIOTROPE. SWEET COLTSFOOT. Height 8 in.: lvs. appearing during or after anthesis, orbicular, margined with small cartilaginous teeth, glabrous above, pubescent and green below: heads fragrant, the marginal fls. of the female heads in the form of short rays. Mediterranean region.

BB. *Blooming April to June.*

palmàta, Gray. Height 6–24 in.: lvs. orbicular in outline, deeply 7–11-cleft beyond the middle, and the lobes sharply dentate, green and glabrous above, densely white-tomentose beneath: heads fragrant, 4–6 lines across, the marginal fls. of the female heads in the form of short rays. E. Asia, N. Amer. B.B. 3:469.

W. M.

PETRÈA (Robert James, Lord Petré, 1710–1742, a patron of botany who had the finest collection of exotic plants in Europe). *Verbenàceæ. Petrea volubilis*, or the Purple Wreath, is one of the rarest, most distinct and beautiful of tender climbers. The flower is like a 5-pointed star of lilac with a good-sized violet in the middle. See Fig. 1726, which indicates the graceful raceme 7–8 in. long, containing perhaps two dozen flowers. The flowers begin to open at the base of the raceme and the showy 5-pointed star is the calyx, whose sepals are colored like petals. The calyx spreads open while the corolla is still a round bud in the middle, and it remains after the corolla has fallen, so that the vine, at first glance, seems to bear two kinds of flowers. The blooms appear in March and April. It should be in every greenhouse collection, although it is of very irregular growth. It does not bloom freely in small plants; it probably has other drawbacks, for it has always been a rare plant in Europe, though often enthusiastically commended. The fls. seem to vary considerably in color: The Purple Wreath is suitable for rafters. Propagated by cuttings of dormant wood taken just before the new growth begins. Give the cuttings bottom heat.

Petrea is a genus of about 16 species of tropical American twining or arborescent shrubs: lvs. opposite, leathery: fls. violet, purple or bluish in long, terminal racemes; calyx-lobes colored during anthesis but often becoming green in fr.; corolla usually a little more intensely colored; limb 5-cut, oblique; stamens 4, didynamous: ovary imperfectly 2-loculed; locules 1-ovuled.

1726. Petrea volubilis.

From a cluster 7 or 8 in. long.

volùbilis, Linn. PURPLE WREATH. Fig. 1726. Lvs. 3–4 in. long, short-stalked, ovate, elliptic or oblong, acuminate or obtuse, entire or wavy. Cuba to Brazil. B.M. 826. F.C. 3:108. Gn. 12:82.

G. W. OLIVER and W. M.

PE-TSAI or Chinese Cabbage. *Brassica Pe-Tsai.*

PETTÈRIA (after Franz Petter, a Dalmatian botanist; died 1853). *Leguminòsæ.* Only one species, very similar in habit to Laburnum, but with the yellow fls. in upright dense racemes, terminal on leafy branchlets. It is but rarely cultivated, since it is less showy in bloom than Laburnum or many species of Cytisus. It is probably hardy as far north as Mass., and requires the same culture as Laburnum, which see. If grafted, Laburnum is to be used as a stock. This monotypic genus is closely allied to Laburnum, but differs by its upright racemes, by the wings and keel being at the base adnate to the stamens and by the sessile ovary. It is said to possess the same poisonous properties as that genus.

ramentàcea, Presl. (*Cytisus fràgrans,* Weld. *C. Wéldeni,* Vis. *Labúrnum ramentàceum,* C. Koch). Upright shrub, to 6 ft.: lvs. 3-foliolate, almost glabrous or sparingly pubescent when young, on about 1 in. long stalks; lfts. cuneate, obovate to oblong, usually obtuse, ¾–2 in. long: fls. fragrant, very short-pedicelled, in 1–3-in. long, dense racemes; calyx 3-lobed, silky; keel silky: pod linear-oblong, sparingly silky, to 1½ in. long. May, June. Dalmatia, Istria. B.R. 29:40.

ALFRED REHDER.

PETTIGREE, Pettigrue, or Butcher's Broom. *Ruscus aculeatus.*

PETÙNIA (South American aboriginal name, said to have been applied to tobacco). *Solanàceæ.* There are twelve or more species of Petunia, mostly native of the southern part of South America. One or two grow in Mexico and another (*P. parviflora*) is naturalized in the southern parts of the U. S. Petunias are small

herbs of straggling or decumbent habit, pubescent and usually viscid, with opposite entire lvs. and large showy axillary flowers. The genus is closely allied to Salpiglossis, being distinguished by having 5 perfect stamens, whereas that genus has 4. The calyx is 5-parted, and, in the cultivated species, several times shorter than the corolla, which is long-salverform or somewhat funnelform and indistinctly 5-lobed. The colors are white to light purple, not blue, clear red nor yellow.

Petunias are of the easiest culture. They demand a warm, open, sunny place. Seeds may be sown directly in the open, or the plants may be started in flats or pots indoors for early results. The plants are tender and therefore should not be trusted in the open until settled weather comes. Thin the plants to 12–18 in. apart. They bloom when very small, and continue to blossom as they grow until destroyed by frost. The common Petunias are rather weedy in habit, but their great profuseness of bloom under all conditions makes them useful and popular. They are particularly useful for massing against shrubbery, for they make a florid undergrowth with almost no care. Some of the modern improved named varieties are very choice plants, and one would scarcely believe, if he were ignorant of the genus, that they represent the same species as the flowers of 25 years ago. These high-bred types require more care in the growing. They would best be started indoors, and be given the choicest positions in the open garden. Petunias are tractable as winter subjects under glass. The best procedure is to sow seeds in late summer or early fall and to grow stocky plants in pots; but old plants can be lifted on the approach of cold weather, cut back, and taken inside for winter bloom. They require cool treatment, a night temperature of 45° to 50° seeming to suit them well.

nyctaginiflòra, Juss. Fig. 1727. Tall and relatively stout, usually growing erect: lvs. large and rather thick, oval-oblong, upper ones nearly or quite sessile and the lower ones narrowed into a distinct petiole: fls. dull white, long-tubed (the tube three or four times the length of the calyx), fragrant at evening. Argentina. B.M. 2552.—Occasionally seen in old gardens.

violàcea, Lindl. Stems slender: lvs. oval or ovate, sessile or very short-stalked: fls. smaller, broad-tubed (the tube twice or less the length of the linear calyx-lobes), rose-red or violet, the limb relatively short. Argentina. B.R. 19:1626. B.M. 3113 (as *Salpiglossis integrifolia*).—Not now in cult. in its pure form.

hybrida, Hort. Figs. 1728–30. The common Petunia, a hybrid derivative of the two preceding. For history, see Bailey, "Survival of the Unlike," Essay 29. P.M. 2:173 (as *P. nyctaginiflora violacea*). B.M. 3556.—This type is wonderfully variable, but it differs markedly from either stem parent: from *P. nyctaginiflora* in its broader tube and many colors; from *P. violacea* in its longer tube, wider limb, and many colors; from both in its much larger and multiform flowers and more stocky growth. In some of the strains, the flower is very broad and open, measuring 4 or 5 in. across. There are types with the flowers deeply fringed; others with star-like markings radiating from the throat and extending nearly or quite to the margin of the limb; others with full double flowers. The colors range from white to deep red-purple, and variously striped and barred. There are forms of very dwarf and compact habit. Only a small proportion of the seedlings of the double strains bear double flowers; but the single flowers are usually of superior size or color. The reason for this small percentage of doubles is the fact that the seed must be selected from single flowers, because the full double ones do not produce seeds. Single flowers carefully pollinated with pollen from double flowers will give seed that will produce an average of 25 per cent doubles, and single flowers bearing petaloid anthers will give an average of 40 per cent doubles. Usually the weaker seedlings, in any batch of a double strain, are most likely to produce double flowers. Fancy varieties may be propagated by cuttings from plants that are carried over winter, although cuttings of double forms do not always come true.

L. H. B.

Petunias in California.—The Petunia is one of the most variable of all flowers and shows a very strong tendency to revert to the natural type. The plant-breeder cherishes not one, but many, ideals. It is the perfect habit of a certain plant that one wishes to combine with the flowers of another. Or the object is to give to this flower a little heavier texture; to another an added frill upon this blossom; a richer color there, a greater depth to this throat, a more distinct ring here, an absolutely pure tone of color in another, to intensify the rainbow tints in another, to deepen the color of those blotches while retaining the pure white background. In an ideal Petunia the first requisite is color, while form, size, texture, marking and habit are all of nearly equal value.

1727. Petunia nyctaginiflora (×⅓).

The California Giant Petunias originated with the undersigned at Ventura, Calif., in 1888, and in their present condition are the result of very careful study through a long series of continuous cross-fertilizations. They are grown in the open ground, and usually transplanted directly from the seed boxes. We have new seedling stock each year, but retain plants the second year for seeding purposes. The strain comprises 19 varieties, including the Ruffled Giants seen in Fig. 1730. The blossoms are all hand-pollinated and in the case of the New Fancy Fringed Perfection Double each seed-pod is handled from 7–12 times.

To those persons who are willing to take the most pains to raise the best Petunias, the undersigned would say that the germination of each seed is of utmost importance, for every seed represents an individual plant. No two Petunia plants give blossoms of the same kind, and there are invariably points of excellence and difference in all. In a packet of seed containing say 200 seeds, the purchaser may feel satisfied if he bring 20 plants to the blooming stage, and may think he has exhausted the possibilities of the strains, whereas the Petunia specialist would know that in those 180 seeds which did not come to the blooming stage a wealth of beauty had escaped him. Then the writer emphatically

urges all to care for each seed. Fill shallow boxes with fine, light soil, say an even mixture of leaf-mold and sand, and wet thoroughly by pouring on boiling water —to prevent trouble from insects and to heat the soil. When the soil has cooled sufficiently but is still warm, sow the seeds very thinly in the boxes, so that the plants may be 1 in. apart. Cover seeds very slightly

1728. Petunia hybrida (× ¼).
Form with short conduplicate foliage.

with a little sifted sand, and place a piece of slate or glass on top of the boxes. If the white root points of germination appear before the leaves, sift on more sand, and watch closely. When the small leaves appear, remove slats and give plenty of light, to produce strong, stocky plants. The soil may now need water, which should be applied very gently, that the tiny seedlings may not be displaced. Later the larger plants may be transplanted from seed-boxes into other boxes or pots. As the weakest plants frequently give the finest blossoms, care should be taken to preserve every plant until the blossoms appear.

Mrs. Thos. Gould.

PEUCÉDANUM (ancient Greek name). *Umbellíferæ*. There are many views as to the limits of the genus Peucedanum, which is equivalent to saying that it has no limits. Bentham & Hooker made it a most complex group, comprising about 100 Old World and New World species, and including such genera as Petroselinum, Anethum, Imperatoria, Tommasinia, Pastinaca, Tiedmannia, Lomatium. Coulter & Rose, the latest American monographers (Monogr. of the N. A. Umbell., U. S. Dept. Agric. 1900), remove the American species and accept Rafinesque's genus Lomatium. With this view we agree, and the cult. species are referred to this genus in the following account. For *Tommasinia verticillaris*, of southern Europe, offered by American seedsmen, see *Tommasinia*. For *P. graveolens*, which we prefer to call *Anethum graveolens*, see *Dill*.

Lomatiums are all western American plants, of about 60 species, growing in dry soil. They are stemless (or nearly so) perennial herbs from tuberous or fusiform roots, and compound (ternate, pinnate or dissected) leaves. From Peucedanum the genus differs, according to Coulter & Rose, as follows: "Peucedanum consists of tall and branching mesophytic plants of low fertile meadows of the Old World, with several umbels, conical stylopodium, and solitary oil tubes; while Lomatium consists of low xerophytic plants of acaulescent habit belonging to the arid regions of western North America, with usually single umbels terminating simple elongated peduncles, no stylopodium, and often several oil tubes." Horticulturally, the Lomatiums are of small value, and they have not been cultivated sufficiently to have given rise to cultural forms. A few of the species have been offered by dealers in native plants. They seem to thrive well in dry, exposed places. They are interesting for the front row of hardy borders and for colonizing in wild open places, and for use in rockwork.

A. *Peduncles usually slender, never swollen at the top.*

B. *Bractlets of involucel conspicuous, often broad or united at base.*

L. dasycárpum, Coult. & Rose (*Peucédanum dasycárpum*, Torr. & Gray). Stem very short or wanting: peduncles several, stout, pubescent, 2 in. or less high: lvs. rather small, pinnately decompound, the numerous segments short-linear: umbel 6–15-rayed, bearing white fls.: fr. nearly orbicular. Southern Calif.

BB. *Bractlets small or wanting.*

C. *Lvs. narrow in outline, pinnate.*

L. Hállii, Coult. & Rose (*P. Hállii*, Wats.). Very short-stemmed, the peduncles 6–16 in. tall and glabrous: lvs. oblong in outline, the segments ovate and deep-toothed or pinnatifid: umbel 3–6-rayed, bearing yellow fls.: fr. broadly elliptical, glabrous. Ore. and Wash.

C. *Lvs. broad in outline, 1–3-ternate.*

L. platycárpum, Coult. & Rose (*P. símplex*, Nutt.). Often tall and stout, but sometimes nearly stemless: lvs. ternate or 2-ternate, the lfts. almost filiform to linear-lanceolate: umbel 3–15-rayed, bearing yellow fls.: fr. broadly oblong to nearly orbicular, sometimes emarginate at each end. Colo. and Utah to Mont. and Wash.

L. triternàtum, Coult. & Rose (*P. triternàtum*, Nutt.). Sometimes 2–2½ ft. high: lvs. 2–3-ternate, the lfts. narrow-linear to linear-lanceolate: fls. deep yellow: fr. narrowly oblong, glabrous. N. Calif. to B. C.

AA. *Peduncle stout, swollen at the top.*

L. nudicaùle, Coult. & Rose (*P. nudicaùle* and *P. leiocárpum*, Nutt.). Stemless, glabrous: peduncle 12–16 in. tall, from a long, fleshy root: lvs. 1–2-ternate or 3-quinate, the lfts. thickish and ovate to narrow-lanceolate: umbel unequally 5–20-rayed, bearing yellow fls.: fr. narrowly oblong. Calif. north and west.

L. H. B.

PEÙMUS (said to be a Chilean name). Syn., *Boldòa*, *Boldea*. *Monimiàceæ*. A genus of one species, the Chilean Boldo, a small tree of considerable economic interest. It has exceedingly hard wood, which is used for making many kinds of implements; it also makes a charcoal said to be prized by smiths above all others. The bark is used in tanning and dyeing. The lvs. are used in medicine. The fruits are edible; they are small berries, sweet and aromatic. Finally it has some ornamental value, being evergreen and fragrant throughout. The fls., which are not very showy, are white, ½ in. across, and borne in small panicles, each branch of which is parted into three. This tree has been advertised in southern California. The male tree has been cult. under glass in Europe, but scarcely outside of botanic gardens and only for its economic interest.

Generic characters: male fls. with 10–12 perianth-lobes, overlapping in 2–3 series, the outer ones herbaceous or membranous, the inner ones more petal-like; disk investing the calyx-tube pilose within; stamens numerous: female fls. smaller, the lobes more inequal,

after anthesis circumscissile above the disk-bearing base and deciduous: drupes 2–5: seeds pendulous; albumen copious.

Boldus, Molina (*Boldòa frágrans,* C. Gay). Attaining 20 ft.: lvs. opposite, leathery, very rough and warty. Chile. B.R. 31:57.

PFÁFFIA (C. H. Pfaff, 1774–1852, German chemist). *Amarantàceæ.* Nine species of slender perennial herbs from Brazil, tomentose or villous, rarely glabrate: lvs. opposite, sessile or nearly so, entire: heads or spikes densely fld.: bracts and bractlets transparent: fls. usually in solitary, long-peduncled heads, bracteate and with 2 bractlets; perianth 5-parted; staminal tube long, 5-cut to the middle, the anther-bearing teeth ciliate at the margin: stigma discoid or head-like, entire or 2-lobed.

Pfaffia gnaphalioides (syn., *Gomphrena gnaphalioides*) has been slightly known to European gardens for a good many years. In 1899, Peter Henderson & Co. offered "*Gomphrena gnaphalioides,* or the Trailing Amaranth," with the remark that it is a desirable trailer for covering embankments and rocks, thrives on poor, dry soil and has white fls. like small clover blossoms. Because of the failure of the seed crop, however, the plant did not become established in the American trade. The probability is that the plant in the trade at present as *Gomphrena gnaphalioides* is incorrectly named. In catalogues the trade plant is figured with the flower-heads in clusters of three and on short stalks, while DeCandolle describes the heads as solitary and long-stalked. Moreover, the true plant has always been regarded as a stove plant in Europe, and at best it could be treated in America only as a tender annual and not as a hardy and permanent subject.

gnaphalioides, Mart. (*Gomphrèna gnaphalioides,* Vahl). Stems subshrubby below: lvs. lanceolate, 10–15 lines long, 2–4 lines wide, soft, ashy gray above, woolly beneath: peduncles 5–7 in. long: heads globose, 6–9 lines across: bracts unequal, ovate, mucronate, scarious, the lower one villous, lateral ones longer, glabrous at the base; stigma globose. W. M.

PFEIFFERA. See *Rhipsalis.*

1729. Petunia hybrida (× ⅓). A double form.

PHACÈLIA (Greek, *cluster;* on account of the crowded flower-clusters of the first described species). *Hydrophyllàceæ.* Annual and perennial plants of the western hemisphere, chiefly North American. The genus includes the old genera Whitlavia, Eutoca, Microgenetes, Cosmanthus, and several others. About 50 species exist in North America, the region west of the Mississippi furnishing by far the greater number. The flowers are mainly of a handsome blue or violet, many

1730. A modern race of fringed Petunia. (× ¼)

species and varieties running through lighter shades to pure white. The annuals are of easy cultivation, requiring, to bring them to perfection, a soil warm, sunny, and not too moist. Some species like a sandy soil, others a firmer clay. Some are erect and give the best effects when planted thickly; others are more spreading and hence require considerable space. In height they vary from only a few inches to several feet. The flowers are borne on more or less recurved racemes that straighten as the flowering proceeds. They vary from an inch long in some species to less than a quarter of an inch in others. In addition to those described below there are many other beautiful species of Phacelia, annuals as well as perennials, that should be in the trade.

Generic description: Annual or perennial plants, with alternate simple or compound leaves, and inflorescence in more or less scorpioid cymes or spikes: corolla deciduous as the capsule enlarges, with various shades of blue, purple or white; tube with or without interval appendages, these when present in the form of 10 vertical folds or projections, adnate to or free from the bases of the filaments: calyx-lobes commonly narrow, often enlarged upwards, especially in fruit: seed-coats reticulated or pitted. The plants are hairy, nearly smooth, or glandular, in whole or in part. The herbage of some of the glandular-hairy species has an offensive odor.

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POPULAR KEY.

A. *Plants viscid-glandular, at least above.*
B. *Foliage simple.*
C. *Base of lvs. usually cordate.* 6. **campanularia**
CC. *Base of lvs. obscurely or not at all cordate.*
D. *Corolla cleft above the middle.*
E. *Fls. blue, with a purple or white center.* 8. **viscida**
EE. *Fls. blue or white all through.* 5. **Whitlavia**
DD. *Corolla cleft below the middle: fls. deep violet.* 7. **Parryi**

BB. *Foliage pinnatifid to compound.*
C. *Lvs. pinnatifid, with entire lobes* ..... 12. **Orcuttiana**
CC. *Lvs., at least lowest, lyrate* .. 9. **fimbriata**
CCC. *Lvs. twice pinnatifid* ..... 2. **glandulosa**
AA. *Plants not viscid-glandular, or hardly so.*
B. *Foliage entire, or a few of the lower lvs. pinnately lobed...*
C. *Habit erect* ..... 1. **humilis**
10. **Menziesii**
CC. *Habit spreading* ..... 11. **divaricata**
BB. *Foliage parted to compound.*
C. *Lvs. pinnately 3-7-parted* .... 3. **congesta**
CC. *Lvs. pinnately 9-17-divided* .. 4. **tanacetifolia**

For fear that this purely artificial key may not be found to apply with all garden plants, which are so much more liable to variation, there is given below a key based on more technical characters, derived from Gray's Synoptical Flora:

BOTANIST'S KEY.

1. Section Euphacelia. Ovules 4, a pair to each placenta; seeds generally fewer, with reticulate or pitted testa: corolla-tube with 10 laminate appendages in pairs at the base of the stamens.

A. *Lvs. all simple and entire, or nearly so* ..... 1. **humilis**
AA. *Lvs. oblong or narrower, pinnately toothed to compound.*
B. *Calyx not setose-hispid.*
C. *Plant viscid-pubescent, glandular* ..... 2. **glandulosa**
CC. *Plant pubescent, not viscid, or hardly so* ..... 3. **congesta**
BB. *Calyx more or less setose-hispid.* 4. **tanacetifolia**

2. Section Whitlavia. Fls. showy: seeds and ovules few to numerous: appendages 5, small and truncate or emarginate and attached to the base of each filament.

A. *Corolla purple or blue, varying to white in cultivation, the tube longer than the lobes.*
B. *Lvs. ovate or deltoid* ..... 5. **Whitlavia**
BB. *Lvs. cordate* ..... 6. **campanularia**
AA. *Corolla violet, rotate-campanulate, the lobes longer than the tube...* 7. **Parryi**

3. Section Cosmanthus. Ovules and seeds few to numerous: appendages to the corolla none.

A. *Plant viscid* ..... 8. **viscida**
AA. *Plant sparsely hirsute* ..... 9. **fimbriata**

4. Section Eutoca. Ovules several to numerous: appendages to corolla 10, vertical and salient.

A. *Plant erect* ..... 10. **Menziesii**
AA. *Plant diffusely spreading* ..... 11. **divaricata**

5. Section Microgenetes. Ovules not pitted nor favose-reticulated, as in the previous sections, but strongly transversely corrugated.

12. **Orcuttiana**

1731. **Phacelia Whitlavia** (× ½).

1. **hùmilis**, Gray. Annual, unbranched or branched from the base, 2–6 in. high, pubescent or inflorescence often hirsute: lvs. spatulate oblong or oblanceolate, generally obtuse, the lower rarely with 1–2 ascending

1732. **Phacelia viscida** (× ½).

lobes: spikes loosely paniculate or solitary: corolla indigo-blue, rather deeply lobed, surpassing the usually linear calyx-lobes; filaments moderately exserted, glabrous or sparingly bearded above. Calif. to Wash.—This pretty little plant seems to be unknown to the trade, but it is to be hoped it will not so remain.

2. **glandulòsa**, Nutt. (*Eutòca glandulòsa*, Hook.). Viscid-pubescent and glandular, softly if at all hirsute, 9–12 in. or more high: lvs. irregularly and interruptedly 2-pinnatifid, or below divided; the numerous lobes oblong, small, somewhat incised, obtuse: calyx-lobes oblong or spatulate: corolla about 2 lines long, bluish, purplish or white, with lobes shorter than the tube; stamens and 2-cleft style moderately or conspicuously exserted: seeds with the minute reticulations even. Northwest Tex. to Ariz. and Mex.

3. **congésta**, Hook. Pubescent and commonly cinereous, hardly viscid or glandular in the least, a foot or more high: lvs. pinnately 3–7-divided or parted, and with a few interposed small lobes, the main divisions oblong or oval, incisely pinnatifid or irregularly lobed, the lower ones mostly petiolate and the upper confluent; calyx-lobes linear or somewhat spatulate; corolla blue, 3 lines long, the lobes as long as the tube; stamens more or less exserted: seeds reticulate scabrous, the fine sharp meshes being, as it were, toothed at the junctions. Tex. B.M. 3452. V. 5:154; 12:140.

4. **tanacetifòlia**, Beuth. Erect annual, roughish hirsute or hispid, not glandular, or above slightly so, 1–3 ft. high: lvs. pinnately 9–17-divided into linear or oblong-

linear once or twice pinnately parted or cleft divisions, all sessile or nearly so, the lobes mostly linear oblong: spikes cymosely clustered, at length elongated: very short fruiting pedicels ascending or erect: calyx-lobes linear or linear-spatulate, not twice the length of the ellipsoidal capsule; stamens and style conspicuously exserted: seeds with very narrow pits bounded by thick walls. Calif. and northward. B.M. 3703.—Var. **álba**, Hort., has been offered.

5. **Whitlàvia**, Gray (*Whitlàvia grandiflòra*, Harv.). Fig. 1731. About a foot high, loosely branching, hirsute and glandular: lvs. ovate or deltoid, incisely toothed: corolla with cylindraceous ventricose tube usually an inch long, thrice the length of the lobes: appendages to the filaments hairy. Southern Calif. B.M. 4813. F.S. 11:1085. G.C. 1854:679.—A beautiful species and much cultivated, with flowers an inch long and nearly as wide. Var. **gloxinioides** (*Whitlàvia gloxinioìdes*, Hort.) and var. **álba** (*Whitlàvia álba*, Hort.) are horticultural forms with spotted and white fls. respectively.

6. **campanulària**, Gray. Lower than the last: lvs. subcordate or cordate, less deeply dentate: tube of the truly campanulate corolla ½ in. long, expanded at throat, barely twice the length of the lobes: appendages to the filaments glabrous and smaller, otherwise much like the last and almost as showy. S. Calif. B.M. 6735. G.C. II. 20:135. F. 1883:145. Gn. 31, p. 554; 55:1206. —*P. campanulata* of some is presumably this plant.

7. **Párryi**, Torr. Rather slender, 9–18 in. high: lvs. ovate, irregularly and incisely double-toothed or laciniate, or the lowest sometimes pinnately parted; the upper continue longer than their petioles: corolla cleft beyond the middle, deep violet, 8 lines across; filaments bearded: ovules on each placenta 20–30; seeds 15–20. Calif. B.M. 6842. G.C. II. 24:716.

8. **víscida**, Torr. (*Eutòca víscida*, Benth.). Fig. 1732. A foot or 2 high, branching, hirsute at base, very glandular above: lvs. ovate or obscurely cordate, doubly or incisely and irregularly dentate, 1–2 in. long: corolla deep blue, with purple or whitish center, from half to nearly an inch in diam. Calif. B.R. 21:1808. B.M. 3572. R.H. 1851:361. J.H. III. 29:183.

9. **fimbriàta**, Michx. (*Cosmánthus fimbriàtus*, Nolte). Weak and diffuse, a span high, somewhat hirsute: cauline lvs. 3-7-cleft or lobed or the lower lyrately divided, the lobes obtuse or roundish: racemes few-fld.: pedicels filiform: calyx-lobes linear-oblong or spatulate; corolla white, only 3–4 lines broad, shorter than the stamens, its lobes fimbriate. Alleghany Mts., Va. to Ala.

10. **Ménziesii**, Torrey (*Eutòca multiflòra*, Dougl.). Plant 9–12 in. high, at length paniculate-branched, hispid or roughish hirsute, usually also minutely cinereous-pubescent: lvs. mostly sessile, linear or lanceolate, entire or a few of them deeply cleft, with few or single linear or lanceolate entire lobes: spikes or spike-like racemes thyrsoid-paniculate, at length elongated and erect: corolla bright violet or sometimes white: ovules 12–16: capsule shorter than the calyx; seeds oblong, coarsely favose-reticulated. Calif. to Wash., and east to Montana and Utah. B.R. 14:1180. B.M. 3762 (*E. Menziesii*).—A beautiful species, and easily cult.

11. **divaricàta**, Gray (*Eutòca divaricàta*, Benth.). Diffusely spreading, a span high, more or less hirsute and pubescent: lvs. ovate or oblong, mostly longer than the petiole, occasionally 1–2-toothed or lobed at base, the rims curving upwards: spikes or racemes at length loose; the pedicels usually much shorter than the calyx: style 2-cleft at apex: ovules 12–20 on each placenta. Calif. B.M. 3706. B.R. 21:1784.

Var. **Wrangeliàna**, A. DC. Fig. 1733. Differs from the type only in having the lvs. inclined to be lobed or 1–2-toothed. It is known to the trade as *Eutoca Wrangeliana*, F. & M. P.M. 5:199.

12. **Orcuttiàna**, Gray. Viscid, pubernlent, about 1 ft. high: lvs. pinnatifid, somewhat lyrate, the lobes short-oblong and entire: fls. sessile in the at length elongated dense spikes; corolla rotate-campanulate, double the length of the calyx, with limb 3–4 lines broad, white, with yellow eye, nearly or quite destitute of internal appendages: capsule oval, nearly equaling the narrowly spatulate (barely 2 lines long) sepals, 12–14-seeded; seeds oval, obscurely favose-reticulated between the transverse corrugations. Lower Calif.

L. F. Henderson.

PHÆDRANÁSSA (Greek, *gay queen*). *Amaryllidàceæ*. Five or 6 species of tender summer-blooming bulbs, with fls. that are tubular in appearance, borne in umbels, generally drooping and usually bright red with green tips. They are all found in the Andes at 7,000–12,000 ft., except *P. Carmioli*, a native of Costa Rica, which differs from all other species in having the perianth segments much shorter than the tube. Probably the choicest species is *P. chlorácra*, the tube of which seems at first sight over 2 in. long; however, the segments are merely connivent most of the distance and it

1733. Phacelia divaricata, var. Wrangeliana (× ½).

is only for a distance of a third of an inch at the base that they are really grown together into a tube. This species has 6–12 fls. in an umbel. Judging from descriptions, the showiest species should be *P. Lehmanni*, which, however, has only 3–4 fls. in an umbel and seems to have dropped out of cult. *P. gloriòsa*, Hort., recommended by some American dealers, seems to be unknown to botanists.

Generic characters: perianth subcylindrical; segments 6, equal, regular, spreading only at the tip: stamens inserted at or below the throat of the tube: ovary 3-celled; ovules many, superposed; capsule globose, loculicidally 3-valved; seeds many, small, black. The lvs. are petioled, oblong or lanceolate, produced after the fls. according to Baker, but this point is doubtful for all species. Baker, Amaryllideæ.

A. *Fls. chiefly red.*

chloràcra, Herb. Bulb globose, 2–3 in. thick: lvs. produced after the fls.: blade 8–12 in. long, 2–3 in. wide; petiole ½ ft. long, according to Baker: fls. scarlet, tipped green. Andes of Ecuador, to 12,000 ft. B.R. 31:17 (petiole 1–3 in. long).

AA. *Fls. chiefly green.*

viridiflòra, Baker. Bulb ovoid, 1½ in. thick: leaf solitary; blade ½–2 in. broad; petiole short: fls. about

4 in an umbel, green towards the tip, without any red, passing into whitish towards the base. Andes of Ecuador.—Possibly a mere color variety of *P. chloracra*.

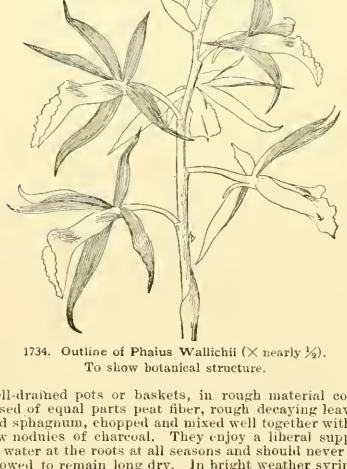
W. M.

PHAIUS (Greek, *dark:* referring to the color of the fls.). *Orchidàceæ*. Often spelled *Phajus*. Very large terrestrial orchids with ample foliage and tall clustered stems terminating in racemes of showy fls.: sepals and petals similar, spreading or half-spreading; labellum large, with the lateral lobes enclosing the column, usually gibbous or spurred behind; column slender; pollinia 8. Distinguished from Calanthe by the free labellum; from Thunia by the leafless, bracted scape which does not terminate the leafy axis. Natives of tropical Asia, Africa, Australia, China, Japan, and the South Sea Islands.

HEINRICH HASSELBRING.

Phaius is a genus of terrestrial orchids, few species of which are commercially valuable, though they are all interesting and worthy of culture in general orchid collections. The *Phaius grandifolius* group comprises, besides the type, several well-marked species and varieties such as *P. Wallichii*, *P. maculatus*, etc., all large-growing sorts of easy culture. These grow best in a moist situation at a temperature of 55° to 60° F. at night, with an advance of 10° by day, during winter months, and a moist, shady location with an active atmosphere during summer, allowing a good supply of water whenever the compost is getting dry, especially during the growing season. Good potting material consists of equal parts of chopped sod, sphagnum and well-rotted cow manure or leaf-mold. One-third of the pot space should be devoted to drainage, covered with sphagnum or rough material to keep it free and open, and the plant should be kept a little below the rim of the pot to allow space for water. They grow very well at the cool end of the Cattleya department.

P. tuberculosus, *P. Humblotii*, *P. Mishmensis* and kindred species, with their hybrids, need a very moist, active atmosphere and a trifle more heat than is required for the last group. They grow well in open,



1734. Outline of Phaius Wallichii (× nearly ⅓). To show botanical structure.

well-drained pots or baskets, in rough material composed of equal parts peat fiber, rough decaying leaves and sphagnum, chopped and mixed well together with a few nodules of charcoal. They enjoy a liberal supply of water at the roots at all seasons and should never be allowed to remain long dry. In bright weather syringing over the foliage will be found beneficial and assists in keeping down red spider and thrips. Stock is increased by dividing the plants between the pseudobulbs. After potting, give them an extra amount of water, atmospheric moisture and heat until they start new action. See also *Thunia*.

R. M. GREY.

A. *Fls. yellow to brown.*

maculàtus, Lindl. Pseudobulbs ovate, 2 in. high: lvs. 3–4, broadly lanceolate, plicate, 1½–2 ft. long, variegated with numerous yellowish spots: flower-stems about 2 ft. high, bearing a raceme of 10–15 yellow fls. each 2–3 in. in diam.; sepals and petals half spreading, oblong, obtuse; labellum erect, with the apex recurved, streaked with orange, wavy and crenate, sides convolute over the column, and the base prolonged into a spur half as long as the ovary. Spring. Northern India and Japan. B.M. 2719 (as *Bletia Woodfordii*); 3960. L.B.C. 19:1803.

Wállichii, Lindl. (*P. bicolor*, Lindl. *P. grandifòlius*, Lindl., not Lour. *P. grandifòrus*, Reichb. f.). Fig. 1734. Tall: lvs. broadly elliptic-lanceolate, 3–4 ft. long: flower-stems erect, 3–5 ft. high, clothed with scales: fls. 4 in. across, varying in color from chocolate-brown to primrose-yellow; sepals and petals spreading, lanceolate, long-acuminate; labellum with an ample elongate tube; limb oblong, acute or acuminate, recurved, margin crisp; spur slender, incurved. The labellum is less variable in color than the sepals and petals. The base of the tube is yellow, dull reddish beyond, with the throat purple with yellow or red edges on the disk; apex white. Feb.–May. Trop. India, northward to the lower Himalaya. B.M. 4078; 7023. P.M. 6:193.—**P. Blùmei**, Lindl., is a form that cannot be distinguished by any botanical character. Ceylon. B.M. 6032.

grandifòlius, Lour. (*Blètia Tánkervillíæ*, R. Br.). One of the oldest orchids in cultivation. It has smaller fls. than *P. Wallichii*, with less acuminate sepals and petals and a shorter obtuse lip and spur: sepals and petals reddish brown, but variable, white on the outside; labellum white at the apex, throat and disk yellow, sides crimson. China, Australia. B.M. 1924. F.S. 7:738. L.B.C. 1:20. G.C. 1872:733; II. 18:565; 111. 3:112. Gn. 3, pp. 183, 221. A.G. 20:279.

AA. *Fls. white to rose-color.*

Humblòtii, Reichb. f. Pseudobulbs, lvs. and habit like *P. grandifolius* but smaller: flower-stem 18–20 in. high, erect: fls. white and rose-colored, tinged and streaked with darker red; sepals oblong-acute: petals twice as wide; labellum spurless, lateral lobes striped with brown on a whitish ground, middle lobe light purple, with a yellow callus. Spring. Madagascar. R.H. 1891:204. G.C. II. 26:173. A.G. 12:161. A.F. 6:609.

tuberculòsus, Blume. Rhizome thick: pseudobulbs small, bearing several lanceolate lvs. 6–9 in. long: fls. 2–3 in. across, in erect spikes; sepals and petals ovate-oblong, white; lateral lobes of the labellum recurved, yellow, almost covered with brownish crimson spots, margin crenately lobed; middle lobe bifid, white, spotted with purple, having 3 thick, yellow keels; margin crisp and crenate. Feb. Madagascar. B.M. 7307. R.B. 18:145. G.C. II. 15:341; 18:565; 21:520; 111. 13:237.—Difficult to grow, requiring a higher temp. than the other species.

Mishménsis, Reichb. f. Stem 2–3 ft. high, leafy above: lvs. 6–10 in. long, elliptic-lanceolate, plicate: scape from the axils of the lower lvs., together with the loose raceme about 2 ft. long: fls. 2 in. across, pale or dark rose-colored; sepals linear-oblong, acuminate; petals narrower; labellum with rounded side lobes and a subquadrate, spotted middle lobe, which is somewhat 3-parted; spur slender, yellow. Himalaya Mts. B.M. 7479.

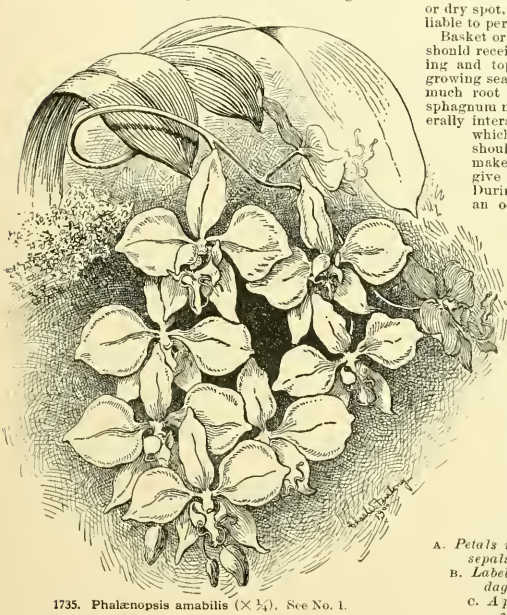
P. Ashworthiànus, Sander. A garden hybrid (P. Mannii × P. maculatus). Fls. large; sepals and petals clear old gold; labellum large, of the same color, with many radiating chocolate lines, outer surface clear yellow. G.M. 40:551.

HEINRICH HASSELBRING.

PHÀJUS. See *Phaius*, above.

PHALÆNÓPSIS (Greek, *moth-like:* suggested by the large white fls. of some species). *Orchidàceæ*. This genus, called by Lindley "the grandest of all orchids," contains some of the most magnificent species

to be found in the orchid family. The plants are natives of the hot regions of India and the Malay Archipelago, growing on trunks of trees and sides of rocks under conditions of high temperature and great moisture. The flowers are remarkably beautiful in form and color. Those of the larger species are borne in graceful



1735. Phalænopsis amabilis (× ¼). See No. 1.

drooping panicles, on which they usually all face in one direction.

The plants are of monopodial growth, having short stems which increase slowly in length: lvs. few, thick, leathery, often mottled: inflorescence a raceme or panicle, large, or not longer than the lvs.: sepals spreading, the lateral ones more or less united with the base of the column: petals about as large as the sepals or very much broader; labellum variously shaped but united with the base of the column. About 40 species.

HEINRICH HASSELBRING.

The species of Phalænopsis are all truly epiphytal, and are found growing in their native habitats on rocks and trees at very low altitudes or at sea-level in moist but often exposed situations where the rains during their growing season are frequent and excessive, and the temperature registers 70°–75° F. during the night and as high as 90°–95° F. during the day. They are principally natives of the Philippine Islands, eastern India, Malaya, Sumatra, Java and Borneo, many of the individual species growing over a wide range of territory.

With but few exceptions, they grow best in the warm portion of the East Indian house where a temp. of 65°–70° F. at night and about 75° F. during the day, or 85° with solar heat, can be maintained through the winter months. The summer temp. may range about 70° F. at night and 80° or 85° by day. Air should be admitted in greater or less degree at all times to keep the atmosphere active, but direct drafts must always be avoided. Shade is necessary except in December and January, but should never be sufficiently heavy to exclude indirect solar influence, as plants grown with overabundant shade, heat and moisture make weak tissue and a thin cuticle incapable of withstanding extremes in temperature and humidity to which they are subjected more or less during the winter months. Such careless treatment invariably results in either wet or dry spot, and the plants, having no pseudobulbs, are liable to perish.

Basket or cylinder culture suits them best, and they should receive all necessary attention, such as rebasketing and top-dressing, at the commencement of their growing season in Feb. or Mar., but they do not require much root space at any time. Chopped live coarse sphagnum makes the best compost; this should be liberally interspersed with rough pieces of charcoal, to which the roots cling freely. The compost should be worked in firmly about the roots to make the plant steady. During the resting period give water when the compost is becoming dry. During the growing season water freely and give an occasional overhead syringing. When the plants are flowering profusely weak liquid cow or sheep manure may be given once a week with good effect.

There is no special means of propagation; young plants are often produced on the flower-scapes, and the old flower-scapes if bent down on the wet sphagnum can sometimes be induced to send up young plants.

R. M. GREY.

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1. **amábilis**, Blume, not Lindl. (*P. grandiflòra*, Lindl.). Fig. 1735. Lvs. long, pale green: fls. variable in size, sometimes nearly 5 in. across, pure white with stains of deep yellow and a few purple spots on the labellum and on the column; dorsal sepals ovate to oblong, lateral sepal lanceolate; petals rounded-fan-shaped; lateral lobes of the labellum obliquely cuneate, incurved, middle lobe very narrow with yellow cirrhi. Autumn. Malay Arch. B.M. 5184. G.C. 1848: 39; Il. 26: 213. Gn. 19, p. 305; 24, p. 560; 34, pp. 516, 517. R.H. 1860, pp. 238, 239; 1897, p. 151. A.G. 16: 271.—Var. **aùrea**, Rolfe (*P. grandiflòra*, var. *aùrea*, Warner). Front half of the lateral lobes of the labellum and the entire middle lobe stained deep yellow. Borneo. **P. Harriettæ**, Rolfe, is a garden hybrid between *P. amabilis* and *P. violacea*. Fig. 1736. Fls. intermediate between the parents, 4½ in. across; sepals and petals pale yellowish white, suffused and dotted with amethyst-purple toward the base; labellum crimson with an orange crest; cirrhi slightly developed. G.C. III. 2: 9. Gn. 38: 766.

1736. Phalænopsis Harriettæ (×¼). See No 1.

2. **Aphrodite**, Reichb. f. (*P. amábilis*, Lindl., not Blume). Lvs. elliptic-lanceolate, 1 ft. or more in length, dark green, obliquely retuse: fls. 3 in. in diam., pure white, with the labellum streaked and spotted with yellow and red; sepals elliptic-ovate; petals large, rhomboid; lateral lobes oblong, middle lobe trowel-shaped, with white cirrhi. Fls. at various seasons, but most freely during summer. Philippines. B.M. 4297. B.R. 24: 34. P.M. 7: 49. F.S. 1: 40. G.C. 1848: 39; Il. 26: 213. Gn. 31, p. 273; 35, p. 362; 38, p. 157; 48, p. 484. R.H. 1897, p. 150. A.F. 6: 89.

Var. **Dayàna**, Hort. (*P. amabilis*, var. *Dayàna*, Hort.), has regular flowers with the lower sepals minutely dotted with crimson, the labellum also being heavily marked with bright crimson. A.G. 21: 457.

Var. **cásta**, Rolfe (*P. cásta*, Reichb. f.). Lvs. thinly spotted: fls. like the type, with a rosy tint especially at the base of the sepals and petals, and a few spots at the base of the lateral sepals.—Scarcely distinct from the following, but distinct from the type.

Var. **leucorrhòda**, Rolfe (*P. leucorrhòda*, Reichb. f.). Lvs. blotched with gray in irregular bands: sepals and petals flushed with rose, the former yellowish outside: calhs yellow, spotted with purple. Philippines. F.M. 1875: 166. R.H. 1896: 500.

Var. **Sanderiàna**, Rolfe (*P. Sanderiàna*, Reichb. f.). Fls. suffused with rose; labellum variegated with brown, purple, and yellow. Island of Mindanao. Gn. 24: 407; 57, p. 44.

Var. **gloriòsa** (*P. gloriòsa*, Reichb. f.). Fls. white, with a rose-colored spot on the labellum. Gn. 35: 697.

3. **intermèdia**, Lindl. A natural hybrid between *P. Aphrodite* and *P. rosea*. Resembles *P. Aphrodite* in habit but the fls. are smaller. Sepals oblong, acute, white; petals rhomboid, much larger, white with few rose spots at the base; labellum small, lateral lobes erect, rose-purple spotted with crimson, middle lobe rich crimson, terminating in 2 short horns. Philippines. —The same type has been artificially produced by crossing the two parent species.

Var. **Pórtei**, Reichb. f. (*P. Pórtei*, Hort.). Fls. large, stained with rose-purple: lvs. about 1 ft. long, deep green. G.C. II. 5: 369, 371. F.M. 1875: 162. J.H. III. 30: 179. Gn. 21: 326. G.M. 38: 111.

4. **Stuartiàna**, Reichb. f. Lvs. elliptic-oblong, obtuse, about 1 ft. long, mottled when young, becoming dull green above and reddish below; panicle large, branched, drooping: fls. 2 in. across; sepals elliptic, obtuse, white or greenish white, the lateral ones speckled with red: petals rounded but obscurely quadrangular, white with few purple dots at base; labellum golden yellow or orange spotted with crimson, white at the tip, lateral lobes obliquely obovate, obtuse, with a pair of cuneate calli between them; middle lobe orbicular, ending in 2 white cirrhi. Jan., Feb. Philippines. B.M. 6622. I.H. 31: 540. F. 1882: 49. Gn. 22: 348; 45, p. 426. G.C. II. 16: 753; III. 4: 389. J.H. III. 34: 157. F.E. 11: 393.—Very near *P. Schilleriana*, but very different in color. Var. **punctatissima**, Hort., has the sepals and petals profusely spotted with purplish red.

5. **Schilleriàna**, Reichb. f. Fig. 1737. Lvs. 6–18 in. long, oblong, dark green and mottled with gray above, purple below: panicle drooping, flat, as much as 3 ft. long and nearly as broad, bearing often over 100 fls. each 2½–3 in. across: dorsal sepals obovate, acute, the lateral ones ovate, rich rose-lilac; petals large, rhomboid, colored like the sepals; labellum colored like the rest of the flower or paler and often spotted with reddish brown and having a yellow callus; lateral lobes rounded-oblong, with 2 quadrangular calli between them, middle lobe oval, ending in two divergent horns. Jan.–March. Philippines. B.M. 5530. F.S. 15: 1559. I.H. 10: 348; 35: 56; 43, p. 154. S.H. 2, p. 47. Gn. 3, p. 183; 22: 348; 33, p. 615; 35, p. 363; 38, p. 157; 48, p. 484. G.C. II. 12: 301; III. 3: 529; 17: 367. F.M. 1877: 257. R.H. 1886: 396. A.G. 14: 65. G.F. 4: 390. A.F. 11: 1081.

6. **Lòwii**, Reichb. f. Lvs. 4–5, oblong, fleshy, deep green, tinged with purple: panicle slender, 5–20-fld.: fls. 1½ in. in diam., white flushed with purple; dorsal sepals broadly ovate, lateral sepals oblong; petals fan-shaped, with a rounded apex; labellum violet-purple, lateral lobes small, reflexed, middle lobe oblong; rostellum very long-beaked. Fls. during summer months. Moulmein (India). B.M. 5351. F.S. 18: 1910. Gn. 9: 14. G.C. III. 2: 745.

7. **Esmerálda**, Reichb. f. (*P. antennífera*, Reichb. f.). Lvs. oblong, acute, 4–8 in. long, gray-green with few dull purple spots: raceme erect, 6–10-fld., 6–18 in. high: fls. about 1 in. in diam., dark or pale purple to white with red streaks; lateral sepals ovate, dorsal sepals obovate; petals obovate; labellum clawed, 3 lobed, lateral lobes ovate to rotund, erect, yellowish; middle lobe broad, obtuse, deep purple; claw with a slender appendage on each side. Cochin China, etc. B.M. 7196. F.M. 1879: 358. R.H. 1877, p. 107.

8. **amethýstina,** Reichb. f. A small species with cuneate-oblong lvs.: fls. small, cream-colored with an amethyst labellum; sepals cuneate-oblong, obtuse; petals subequal or a little smaller; lateral lobes of the labellum cuneate; middle lobe obovate, notched. Malay. G.C. 1870:1731.

9. **violàcea,** Teijsm & Binn. Lvs. oblong, 8–12 in. long, light shining green: flower-stalks not longer than the lvs.: fls. few, 2 in. across; sepals and petals broadly lanceolate, yellowish white, changing to rose-violet toward the base; middle lobe of the labellum fleshy, deep purple, with a yellow callus; side lobes small, erect, purple and orange. May–Oct. Sumatra. F. M. 1879:342. G. C. II. 16:145.—Plant of dwarf habit. The fls. remain on the plant a long time.

10. **Cornu-cérvi,** Blume & Reichb. f. Lvs. about 9 in. long, leathery, oblong: flower-stem about as long as the lvs., erect, clavate, bearing 6–12 fls.: fls. yellowish green, barred with reddish brown; sepals and petals fleshy, lanceolate, the latter smaller; labellum whitish, lateral lobes erect on the irregular, fleshy, excavated claw, middle lobe crescent-shaped, apiculate. Summer. Trop. Asia, Java and Sumatra. B.M. 5570 (as *Polychilos Cornu-cervi*).

11. **speciòsa,** Reichb. f. Lvs. oblong: fls. stellate, in racemes or panicles, white, blotched with rose-madder; sepals oblong; petals narrower; labellum with erect, linear, tootbed, yellow side lobes, and a fleshy, purple and white middle lobe ending in a hairy cushion. Andaman Islands (Bay of Bengal). G.C. II. 18:745; 26:277.

12. **Sumatràna,** Korth. & Reichb. f. Lvs. pointed, about 6 in. long: inflorescence about as long as the lvs., 6–10-fld.: sepals oblong, pointed, 1 in. or more in length; petals more cuneate; all yellowish white barred, with bands of reddish brown; labellum short, clawed; lateral lobes erect, meeting and each having a short curved tooth pointiug backwards; middle lobe oblong, fleshy, white, streaked with violet, very hairy in front. Sumatra and Borneo. B.M. 5527. F.S. 16:1644. G.C. 1865:507.

13. **Lüddemanniàna,** Reichb. f. A small plant, with thick, oblong fleshy lvs. 6–8 in. long: inflorescence about as long as the lvs., with few handsome fls. near the top: fls. 2–3 in. across; sepals and petals oblong-acute, white, marked with transverse bars, those at the base being amethyst, while the upper ones are brown; labellum deep violet, with yellow blotches on the side lobes; middle lobe oblong; side lobes erect, ligulate, deeply 2-toothed. Feb., March. Philippines. B.M. 5523. F.S. 16:1636. R.H. 1872:390. F. 1865:257.—The old flower-stems of this plant produce young plants by which the species may be easily increased.

Var. **ochràcea,** Reichb. f. A form with yellowish fls. and ochre-colored bars. R.H. 1872:390.

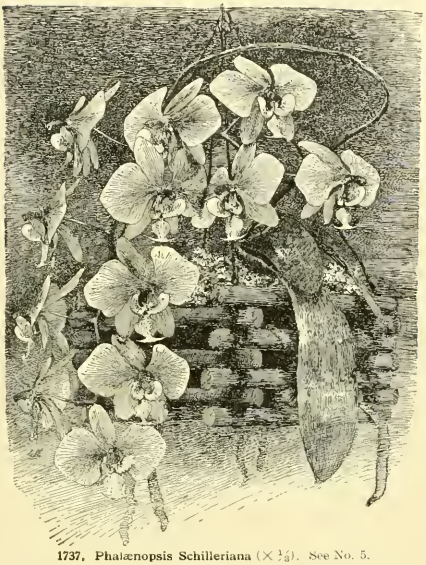
14. **Párishii,** Reichb. *f.* Dwarf: lvs. oblong-lanceolate, acute, 2–4 in. long: fls. in 6–10-fld. racemes scarcely longer than the lvs., crowded; dorsal sepals oblong, lateral broadly ovate, white; petals obovate-spatulate, white; lateral lobes of the labellum small, horn-like, yellow, with purple spots, middle lobe broadly triangular, red-purple, often white on the disk; crest semilunar, broken up into subulate filaments in front; the disk has a peculiar appendage ending in 4 long subulate filaments. Burma and Moulmein. B.M. 5815.

15. **ròsea,** Lindl. Lvs. oblong, dark green, obliquely retuse: scape about a ft. long, nodding, dark purple, bearing 12–14 fls.: sepals and petals ovate, obtuse, white, tinged with pink in the center; labellum rose-colored, scarcely longer than the sepals; lateral lobes small, lunate, middle lobe ovate. Philippines. B.M. 5212. F.S. 16:1645. G.C. 1848:671.

P. Listerii. Advertised, but doubtful.—*P. Valentini,* Reichb. f. Plant of the habit of P. violacea, with narrower lvs.: sepals cuneate-oblong, purple, with the lateral sepals white at the base: petals like the lateral sepals or barred with purple; labellum short, clawed, mauve, white and yellow. Malay.

HEINRICH HASSELBRING.

PHALÁNGIUM Liliástrum. See *Paradisea Liliastrum.*



1737. Phalænopsis Schilleriana (×⅓). See No. 5.

PHÁLARIS (old Greek name used by Dioscorides, probably from *phalos,* shining; in allusion to the shining seed). *Gramineæ.* Ten species, mostly of southern Europe, one native throughout the northern part of North America, a variety of which is the Ribbon Grass. *P. Canariensis,* Canary Grass, which is cultivated in Europe for bird-food or sometimes as a cereal, is occasionally found in this country along roadsides. This annual species, on account of its variegated ovate spikes, is worthy of cultivation as an ornamental grass. Spikelets 1-fld., collected in heads or spike-like panicles. Empty glumes 4, but the second and third minute. Outer glumes boat-shaped, awnless.

arundinàcea, Linn. REED CANARY GRASS. A tall perennial (2-6 ft.) with flat ½ in. wide lvs. and an elongated spike-like panicle (open in anthesis) of whitish spikelets, native through northern America in wet ground, where it is an important forage grass. Recommended for planting in parks and grounds along the banks of streams or artificial ponds. A very striking native grass.

Var. **variegàta** (var. *picta*). RIBBON GRASS. GARDENER'S GARTERS. Fig. 1738. Lvs. longitudinally striped with white. Commonly cult. for ornament and sometimes run wild about old places.

A. S. HITCHCOCK.

PHALOCÁLLIS (Greek words referring to the delicacy of the cone formed by the crests). *Iridàceæ.* Referred by Baker to Cypella. The plant offered as *P. plumbea,* Herb., by Dutch bulb-growers is **Cypélla plumbea,** Lindl., a South Brazilian species differing from those described at p. 429 as follows: corm large: lvs. lanceolate: stem stout, 2–4 ft. long: fls. dull lilac; outer segments 1¼–2 in. long; inner with a small obovate blade and long claw; style-branches 2-fid, each fork with 1 erect and 2 spreading spurs. B.M. 3710 (fls. chiefly lilac). F.S. 4:395 (chiefly light blue). F.S. 14:1466 (*flore striato,* veined and flushed with rich purple shades on a white ground).

PHÁRBITIS. See *Ipomœa.*

1738. Ribbon Grass—Phalaris arundinacea, var. variegata.
(See page 1293.)

PHASÈOLUS (ancient Latin name, somewhat altered, of a bean). *Leguminòsæ*. Bean. Annual or perennial mostly twining herbs, or some of them woody at the base, with mostly pinnately 3-foliolate stipellate leaves, axillary peduncles bearing clusters of white, yellow, red or purplish papilionaceous flowers, and more or less compressed (flat-sided) several to many-seeded 2-valved pods. Many species have been described, all of warm countries, but there are probably not more than 100 kinds that can be clearly separated as species. From its allied genera, Phaseolus is separated by minute characters of calyx, style and keel. In Phaseolus the style is bearded along the inner side, and the stigma is oblique or lateral rather than capitate on the end of the style; the keel is coiled into a spiral body, including the 10 diadelphous stamens (in 9 and 1).

Since Phaseoli are tropical or warm-country plants, they must not be subjected to frost. Most of them are garden annuals which are given a warm place after all danger of frost is past. One of them, *P. Caracalla*, is sometimes grown as a greenhouse climber, but in California and other warm parts it thrives in the open and climbs hedges and trees, often smothering them. The culture is set forth under *Bean*, but the species are contrasted below. See, also, *Canavalia*, *Glycine*, *Mucuna*, *Vicia*, *Vigna*.

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A. *Perennial tall-twining species, with large, fragrant, showy fls., and nearly or quite glabrous lvs.*

1. **Caracálla**, Linn. Caracol. Snail-Flower. Cork-screw-Flower. Leaflets broadly rhombic-ovate, pointed or acuminate: fls. large and fleshy, in axillary racemes, light purple to yellowish, very fragrant, the large keel coiled like a snail shell. Tropics, probably of the Old World. B.R. 4:341. V. 2, p. 370.—Naturalized in parts of California, where it grows 20 or more feet high, sometimes becoming a nuisance. It is an old-fashioned glasshouse plant in cold climates, but is now rarely seen. It is sometimes planted out in summer.

2. **adenánthus**, Meyer (*P. amœnus*, Soland. *P. Truxillénsis*, HBK. *P. cirrhòsus*, HBK.). Foliage much like that of the last, the lfts. ovate and somewhat acute: fls. very showy, red (or light blue ?), fragrant, in dense almost capitate clusters: pod 4–6 in. long, usually curved. Tropics; grown sparingly in southern California.

AA. *Perennial from tuberous roots (but P. multiflorus grown as an annual N.), the fls. either large or small, the lvs. pubescent or scabrous.*

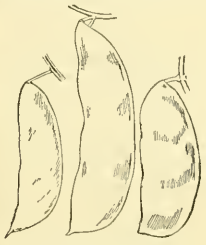
3. **multiflòrus**, Willd. Scarlet Runner Bean. Dutch Case-Knife Bean (a white variety). Fig. 1739. Root thickened and tuberous, perennial in the South but perishing in the North: plant tall-twining and slender, minutely pubescent: lfts. thin, rhombic-ovate and acute, scabrous-pubescent: fls. rather large and showy, in racemes, in the Scarlet Runner type red, in the Dutch Case-Knife white, the keel not distinctly projecting: pods long (3–6 in.), with a curved slender type: beans large and plump, much flattened or nearly cylindric, red and black in the Scarlet Runner, white in the many other forms. South American or Mexican, but now widely spread.—The Scarlet Runner form is popular as an ornamental vine for arbors and to cover windows, sometimes being known as Flowering Bean or Painted Lady. The Dutch Case-Knife is a vegetable-garden plant, grown for its beans. Various forms of the plant are grown for food by the Mexicans, and these sometimes appear in our western country. Melde's Perennial and Irvine's Hybrid beans are apparently white-fld. forms. The color of flower and seed seems always to be associated in this species. A dwarf or "bush" form, probably of *P. multiflorus*, was introduced a few years ago as Barteldes' Dwarf Lima (see Bull. 87, Cornell Exp. Sta.). Fig. 1740. It is not unlikely that more than one species is passing as *P. multiflorus*, some of the Mexican forms being imperfectly understood.

1739. Phaseolus multiflorus (× ⅓). White-seeded form.

1740. Barteldes Bush Lima (× ⅓). Probably a form of *Phaseolus multiflorus*.

4. **retùsus,** Benth. METCALFE BEAN. Root very large, said sometimes to weigh 30 lbs., running deep into the ground: stem trailing, roughish: lfts. rhombic to oblong, mostly obtuse and often retuse, rough on both sides: fls. in loose, interrupted racemes, rather small, purple: pod flat, short, broadly oblong, somewhat curved. Tex., west and

1741. Sieva Bean—Phaseolus lunatus (×½)



1742. Pods of Sieva, Large Lima, Potato Lima (×⅓).

The two last are forms of *P. lunatus*, var. *macrocarpus*.

south.—Lately recommended as a forage plant in the dry regions of the Southwest. The lvs. are thick and heavy and well adapted to dry, hot climates. Stems grow 8–10 ft. or more long.

AAA. *Annual (at least in the N.), either twining or "bush," the lvs. mostly pubescent, cult. for food.—Garden beans of various kinds.*

B. *Pod usually ¼ in. or less broad: usually not climbing.*

5. **aconitifòlius,** Jacq. MOTH BEAN. A diffuse, bushy or somewhat trailing plant with loosely brown hairy

1743. Henderson Dwarf Lima, a form of Phaseolus lunatus (×½).

slender stems, growing 1–2 ft. tall: lfts. mostly ovate to rhombic-ovate, 2–3-lobed at the apex for one-fourth to one-half their length, the lobes narrow and obtuse; stipules small, narrow and pointed: fls. very small, yellowish, in heads on the ends of hairy axillary peduncles: pod becoming 2 in. long, nearly cylindrical, glabrous, India, where it is cult. for human food and for forage, but only rarely seen in collections in this country. it is said to be able to withstand much dry weather.

6. **Múngo,** Linn. GRAM. Erect or nearly so, 1–2 ft., stout, with the furrowed stems densely clothed with long brown hairs: lvs. large and long-stalked; lfts. very broadly ovate or nearly rhomboid-orbicular, usually entire, thin, short-acute; stipules large, ovate: fls. rather small, yellowish, in a capitate cluster of 5 or 6 on the end of the stout hairy peduncle: pod 3 in. or less long, nearly cylindrical, somewhat curved, bearing 10–15 beans. S. Asia, where it is everywhere cultivated for human food.—Rarely seen in this country. In habit it somewhat resembles the Soy bean (Glycine). The slender pod is hairy at first, but the hairs are deciduous. It is very variable. From botanists it has received many names.

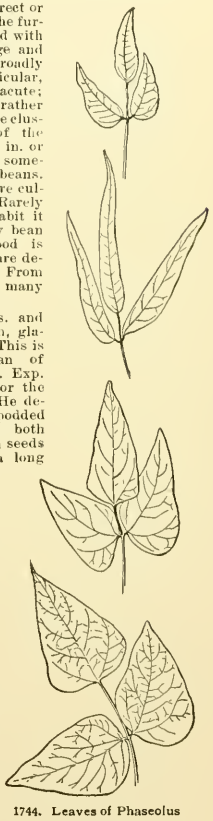
Var. **glàber,** Roxbg. Lvs. and pod, and sometimes the stem, glabrous.—A domestic form. This is probably the Adzuki bean of Georgeson, Bull. 32, Kans. Exp. Sta., where it is praised for the high quality of the bean. He describes 2 forms, the White-podded and Black-podded Adzuki, both with small red or brownish seeds with truncated ends and a long narrow scar. Pods 3–5 in. long.

Var. **radiàtus,** Hook. f. (*P. radiàtus,* Linn.). Stems twining, all parts densely hairy.

BB. *Pod usually ½ in. or more broad: plants naturally climbing, but giving rise to "bush" forms.*

C. *Beans large and usually flat.*

7. **lunàtus,** Linn. SIEVA or CIVET BEAN. Figs. 1741–4. Small and slender, usually not climbing very high: lfts. thin, short and broad, ovate-pointed (except in special forms, as the Willow-leaf): fls. of medium size, white or whitish, in axillary racemes: pods small and papery, 2–3 in. long, much curved on the back and provided with a long tip, splitting open when ripe and the valves twisting: beans small and flat, white, brown or mottled. Trop. America.—Widely cult. in warm countries, and prized for its earliness and prolificacy. It gives rise to dwarf or bush forms, as the Dwarf Carolina, Henderson Bush Lima (Fig. 1743). Common in American gardens.



1744. Leaves of Phaseolus lunatus.

Two upper ones, Willow Leaf, a very narrow-leaved form of the Sieva type; middle one, Potato Lima; lowest one, Large White Lima, the two later being var. *macrocarpus*.

Var. **macrocárpus,** Benth. (*P. inamœnus,* Linn. *P. Limènsis, saccharàtus, fœcùndus, latisiliquus,* Macfadyen. *P. pubérulus,* HBK. *P. Xuarèzii,* Zucc.). LIMA BEAN. Figs. 1742, 1744. Distinguished from the Sievas by tall, robust growth and late ripening: lfts. large and thick, ovate-lanceolate: pods fewer to the raceme, straight or nearly so, without a prominent tip,

not readily splitting at maturity: beans very large, white, red, black or speckled. South Amer.—Widely grown in the tropics, and one of the richest of beans. Unreliable in the northern states because of the short, cool seasons. There are two forms in cult. in the U. S.: Flat- or Large-seeded Limas, with seeds very flat and

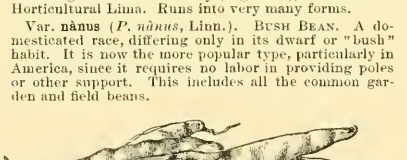
1745. Leaf of Phaseolus vulgaris.

veiny and more or less lunate in shape, and very broad flat pods, with a distinct but not prominent pod, and broad-ovate lfts.; Potato Limas, with smaller tumid seeds, shorter and thicker pods, with a very short point, and long-ovate, tapering lfts., with angular base. In both these groups there are dwarf or bush forms.—Burpee Dwarf Lima in the former, and Kumerle Dwarf Lima in the latter. The Lima Bean is perennial in the tropics.

cc. *Beans relatively small, oblong and nearly cylindrical.*

8. **vulgàris,** Linn. Common Bean. Kidney Bean of the English. Haricot of the French. Figs. 1745–7. Slender, twining, more or less pubescent: lfts. rhombic-ovate or ovate, acuminate: peduncles shorter than the petioles, few-fld. at or near the apex: fls. small, white, yellowish or blue-purple: pod slender, somewhat curved, provided with a straight or curved tip. Now believed to be tropical American.—Here belong all the common garden pole beans, aside from the Lima types, including the Pole Cranberry (Fig. 1747), and so-called Horticultural Lima. Runs into very many forms.

Var. **nànus** (*P. nànus,* Linn.). Bush Bean. A domesticated race, differing only in its dwarf or "bush" habit. It is now the more popular type, particularly in America, since it requires no labor in providing poles or other support. This includes all the common garden and field beans.



1746. Long-podded forms of Phaseolus vulgaris.

For a history of garden or kidney beans, see Georg von Martens, "Die Gartenbohnen," 1869. He makes 7 specific types and many subtypes or botanical varieties. His species are: *P. vulgaris,* Savi. Pod straightish and subtorulose, long-mucronate; seeds somewhat compressed, oblong-reniform. *P. compressus,* Martens Climbing: pods compressed and broad, short-mucronate; seeds strongly compressed, oblong-reniform. *P. gonospermus,* Savi. Climbing: pod subincurved, torulose and short-mucronate; seeds somewhat compressed and irregularly angular-truncate. *P. carinatus,* Martens. Climbing: pod falcate and rugose; seeds teretish, elongated, somewhat truncate-carinate. *P. oblongus,* Savi. Dwarf, erect: pod subcylindrical, straightish, long-mucronate; seeds subreniform-cylindric, twice longer than broad. *P. ellipticus,* Martens. Low, erect or somewhat climbing: pod straightish, more or less torulose; seeds small, tumid-elliptic. *P. sphaericus,* Martens. Nearly erect, or climbing: pod straightish and constricted; seeds large and subglobose.

L. H. B.

PHEASANT'S EYE. *Narcissus poeticus, Dianthus plumarius,* and *Adonis.*

PHEGÓPTERIS (Greek, *beech-fern*). *Polypodiàceæ.* Beech, Oak or Sun Fern. A genus of ferns allied to Dryopteris in habit, but with no indusium, the sori being entirely naked. There are numerous tropical American and Sandwich Island species worthy of cultivation in warmhouses. Three of our native species are sometimes offered in the trade. For culture, see page 575.

A. *Fronds (lvs.) small or medium-sized, at most tripinnatifid. (Native species.)*

B. *Lvs. bipinnatifid, broadly triangular.*

hexagonóptera, Fée (*Polypòdium hexagonópterum,* Michx.). Lvs. 9–15 in. long, usually broader than long, pale green; lower pair of pinnæ deflexed and set forward; sori marginal. Eastern U. S.

polypodioides, Fée. Lvs. 5–9 in. long, longer than broad, dark green, slightly hairy beneath; sori nearer the margin than the midrib. Eu. and northeastern N. Amer.

BB. *Lvs. tripinnatifid, lanceolate.*

alpéstris, Fée. Lvs. 1–2 ft. long, 6–8 in. wide, with numerous finely cut lanceolate pinnæ, the lobes toothed; thinly herbaceous. Eu. and northwest Amer. Has the habit of *Asplenium filix-fœmina*

BBB. *Lvs. ternately tripinnatifid.*

Dryópteris, Fée. Oak Fern. Lvs. triangular, 3–9 in. each way, the lowest pinnæ nearly equal to the central (terminal) portion, giving the leaf a ternate appearance. Eu. and N. Amer.

1747. Cranberry Pole Bean — Phaseolus vulgaris (× ½).

AA. *Fronds (lvs.) several feet long, decompound.*

Kerandreniàna, Gaud. Lvs. several feet long, decompound with light brownish polished stalks, and straw-colored rachides; texture herbaceous; sori near the margins of the segments. Sandwich Islands. Also advertised under *Polypodium.*

L. M. Underwood.

The American species are of easy culture in shady places, and increase rapidly by creeping rootstocks. The fronds are light green, of a distinct and attractive hue. They have the fault of dying down for the season before the summer is over, especially when growing in rather dry positions. *P. polypodioides* prefers a moist, shaded place. It is not so quickly deciduous as the other two species. *P. hexagonoptera* is suited for almost any shaded position. The fronds often die down in August, and at this season are occasionally much and handsomely variegated with pure white. *P. Dryopteris* is one of the most beautiful of small American hardy ferns. It is eminently suited to shady rockwork, though it completes its growth early in the season.

F. W. Barclay.

PHELLODÉNDRON (Greek, *phellos,* cork, and *dendron,* tree; alluding to the corky bark). *Rutàceæ.* Ornamental deciduous trees with large, opposite, odd-pinnate lvs., inconspicuous greenish fls. in short terminal panicles and black frs. *P. Amurense* is quite

hardy as far north as Mass., but *P. Japonicum* is somewhat tender; the first has been recommended as a street tree for western cities, as it resists drought and heat in summer and seems to be not attacked by insects. It is of rapid growth when young and forms a rather low, round head. It seems to grow in almost any kind of soil except in a very moist one. Prop. by seeds, which are produced freely when both sexes are planted and by root cuttings, dug up in fall and stored during the winter in moist sand or sphagnum. Two closely related species in E. Asia and Japan. Fls. dioecious, in terminal short panicles; sepals and petals 5–8, ovate-lanceolate; stamens 5–6, longer than petals; ovary 5-celled, with a short, thick style: fr. a black drupe with 5 small one-seeded stones.

Amurénse, Rupr. Chinese Cork Tree. Tree, to 50 ft., with spreading branches forming a broad, round head; bark of the trunk light gray, corky; almost glabrous: lfts. 7–17, ovate to ovate-lanceolate, narrowed or rounded at the base, long-acuminate, minutely crenulate, dark green and somewhat shining above, glaucescent and glabrous beneath or pubescent only on the midrib: fr. globose, black, about ½ in. across, with a strong turpentine-like odor when bruised. June. N. China, Amurland, Japan.

Japónicum, Maxim. Closely allied to the preceding. Lfts. ovate, rounded or truncate at base, acuminate dull green above, pubescent beneath, with rather prominent veins; leaf-stalk and inflorescence pubescent. June. Japan.—Less hardy than the preceding and probably only a variety of it; but sometimes thrives in New England.

Alfred Rehder.

PHENOLOGY (contraction of *phenomenology;* that is, the science of phenomena): the study of the relationships between the climate of any place and the annual periods of plants and animals. Plants vegetate, bloom, and ripen fruit at more or less definite seasons, each after its kind; animals mate, bear young, migrate and hibernate each also after its kind; but these recurring events are related to the climate in which these things live: with these inter-relationships Phenology has to do. The most complete means of comparing the climate of one year with that of another are the life-events of the animals and plants of the years. Thermometrical readings are the customary measures, but the thermometers record only temperature, whereas local climate is modified by conditions of humidity, cloudiness, the sequence of atmospheric changes, and many subtle agencies which cannot be measured by means of instruments. Living things are the agents that really measure climate. A record of the life-events of living things, therefore, even though imperfect, should contribute to the science of climatology; and incidentally it should contribute much to the science of biology. Records of plant-events are more comparable than those of animal-events, because plants are stationary and have no volition to adapt themselves to inclemencies by means of change of position, diet, or otherwise; therefore, plants emphatically express climatal influence. A record of the first blooming of a given apple tree, for example, during a series of years would give comparable measures of the lateness or earliness of the different seasons. Most so-called phenological observations in this country have been mere records of dates of blooming, leafing, migration of birds, peeping of frogs, and the like, without correlative data respecting the local climate. They are therefore of relatively little consequence to science. In this country the literature of Phenology is very meager. See Bailey, Essay 17, "Survival of the Unlike," and "Instructions for taking Phenological Observation," "Weather Review," Sept., 1896, U. S. Weather Bureau.

L. H. B.

PHILADÉLPHUS (name of an ancient Egyptian king; applied to this genus with no obvious reason). *Saxifragàceæ.* Mock Orange. Syringa. Ornamental deciduous or rarely half-evergreen shrubs with opposite entire or serrate lvs. and white showy fls. in terminal racemes or solitary on short branchlets, appearing mostly in June and often very fragrant. Most of them are hardy North except *P. Coulteri, Mexicanus* and the other Mexican species; *P. tomentosus* and *Billardi* are only half-hardy. They are well adapted to shrubberies and are mostly of medium height, the tallest being *P. pubescens,* which grows to about 20 ft.; *P. Gordonianus* and *P. inodorus* grow nearly as high, while *P. microphyllus* hardly exceeds 3 ft. They thrive well in almost any well-drained soil and even under trees. If pruning is needed it should be done after flowering, since the fls. appear on the wood formed the previous year. Prop. usually by hardwood cuttings, or by suckers and greenwood cuttings under glass; also by layers and by seeds, but they are very apt to hybridize when several species are growing together.

About 30 species have been described. They are distributed through the northern hemisphere; in N. Amer. south to Guatemala and from southeast Europe to Himalayas and Japan. All are shrubs with exstipulate, petioled more or less distinctly 3-nerved lvs.: fls. solitary or racemose; calyx-lobes, petals and styles usually 4; stamens 20–40: fr. a dehiscent, 4-valved, many-seeded capsule. Owing to the absence of well-marked characters the species are often rather difficult to distinguish, and this difficulty is much increased by the numerous hybrids which have originated in cultivation. The latest account of this genus is a short monograph by E. Koehne in Gartenflora, Vol. 45 (1896), p. 450, etc., where 33 species are distinguished, of which 20 are American.

It seems strange that Philadelphus is popularly known under the name of Syringa, a very different genus of no botanical affinity and little resemblance; but this is only continuing the usage of the old herbalists who used to unite under Syringa species of Philadelphus, Syringa and Jasmine. Thus we find in Gerarde's "Herball," first published in 1597, descriptions and figures of *Syringa alba,* White Pipe, *S. cærulea,* Blue Pipe, and *S. Arabica,* Arabian Pipe, the

1748. Philadelphus coronarius—Mock Orange (× ½).

first being *Philadelphus coronarius,* the second *Syringa vulgaris* and the third *Jasminum Sambac.* This accounts also for the German popular name Jasmine for Philadelphus. In French Syringa has been changed to Seringa, and is used in this form as the popular name for Philadelphus. Linnæus decided to take up the name Syringa for the *S. cærulea* of the older botanists and *Syringa alba* he called Philadelphus, a name previously used for the same plant by some of the old herbalists.

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microphyllus, 14.
Mont Blanc, 10.
multiflorus plenus, 8.
nanus, 8.
nivalis, 1.
Pekinensis, 6.
primuliflorus, 8.
pubescens, 1.
roseiflorus, 8.
salicifolius, 8.
Satsumi, 4.
speciosissimus, 9.
speciosus, 11.
spectabilis, 1.
triacrrius, 13.
undulatus, 11.
Yokohamæ, 4.
Zeyheri, 9.

A. *Bark of last year's branches not peeling off. fls. in racemes.*

B. *Calyx pubescent outside: bark gray.*

1. **pubéscens,** Loisel. (*P. latifólius,* Schrad. *P. grandiflórus,* var. *floribúndus,* A. Gray). Shrub, to 20 ft. high: mature branches of this year yellowish brown, those of last year light gray: lvs. broadly ovate, dentate, pubescent beneath, 2–4 in. long: racemes rather loose, 5–11-

1739. Philadelphus coronarius.

fld.: fls. creamy white, scentless, 1½–2 in. across, June, July. Tennessee. B.R. 7:570 and Gn. 40, p. 289 (as *P. grandiflorus*). B.R. 23:2003 and G.C. II. 16:81 (as *P. speciosus*).—The figures quoted above do not represent typical plants; they are probably partly hybrids of this species with *P. grandiflorus* and *inodorus,* but the figure accompanying the original description by Loiseleur in Herbier gen. de l'amateur, Vol. IV, t. 268, agrees well with wild plants from Tennessee. A dwarf form with double fls., cult. as *P. nivalis spectabilis flore pleno,* probably belongs to this species. *P. pubescens* of Koch and of Koehne is *P. verrucosus;* see supplementary list.

BB. *Calyx glabrous outside: bark brown or grayish brown.*

2. **Gordoniànus,** Lindl. Shrub, to 12 ft., with grayish brown branches: lvs. broadly ovate to elliptic, coarsely dentate, especially those of the young shoots, light green, pubescent beneath, thin, 1½–3 in. long: racemes dense, 5–7-fld.: fls. pure white, scentless, 1½–1¾ in. across: petals oval-oblong: ovary half-superior. June, July. Wash. to Ore. B.R. 25:32. Gn. 3, p. 233.

3. **Léwisi,** Pursh. Upright shrub, to 8 ft.: bark of branches dark or grayish brown, usually with numerous horizontal cracks: lvs. broadly ovate or elliptic-ovate, entire or sparingly dentate, glabrous or somewhat hairy beneath, thickish at maturity, 1½–3 in. long: racemes short and dense, 5–9-fld.: fls. short-stalked, 1–1½ in. across, scentless. June, July. Brit. Colo. to Calif.

4. **Satsùmi,** Sieb. (*P. Yokohámæ,* Hort.). Shrub, to 8 ft., erect: branches of last year with grayish brown bark, usually marked with whitish, longitudinal fissures: lvs. ovate, long-acuminate, dentate or sometimes entire, almost glabrous, 3–6 in. long: racemes loose, erect, 7–9-fld.: fls. about 1 in. across, slightly fragrant. May, June. Japan.

AA. *Bark of last year's branches peeling off in thin flakes, brown.*

B. *Fls. in many-fld. panicles, but sometimes racemose on weaker branches.*

5. **Califórnicus,** Benth. Upright shrub, to 8 ft., with brown branches: lvs. ovate, with few teeth or almost entire, glabrous or somewhat pubescent beneath, thickish at maturity, 1½–2½ in. long: fls. ¾–1 in. across, scentless; petals oblong. June, July. Wash. to Calif. —Similar in habit to *P. Lewisi,* to which it is usually referred as a variety.

BB. *Fls. in 5–9-fld. racemes, rarely 3.*

C. *Lvs. glabrous or nearly so beneath, ovate-lanceolate: pedicels glabrous.*

6. **Pekinénsis,** Rupr. (*P. coronàrius,* var. *Pekinénsis,* Maxim.). Upright shrub, to 5 ft.: lvs. ovate-lanceolate, acuminate, denticulate, thickish at maturity, 1½–3 in. long; petioles purplish: racemes short and dense, usually 5–11-fld.: fls. 1⅓ in. across, slightly fragrant; style divided only at the apex. May, June. Mongolia, N. China.—Dense, upright, but rather low, free-flowering shrub.

7. **Fálconeri,** Sarg. Shrub, to 8 ft., with slender, arching branches: lvs. ovate-lanceolate, acuminate, denticulate, 1½–3 in. long, thickish at maturity: fls. 3–7, slender-pedicelled, fragrant, pure white, about 1½ in. across; calyx-lobes lanceolate; petals oblong, acute; style much longer than stamens, deeply divided. June. Origin unknown; probably Japanese. G.F. 8:497. M.D.G. 1899:231. Gng. 8:340.—Very graceful shrub, wide-spreading.

CC. *Lvs. more or less pubescent beneath, usually ovate.*

8. **coronàrius,** Linn. Fig. 1748, 1479. Shrub, to 10 ft., with upright branches: lvs. ovate to ovate-elliptic, usually acute at both ends, denticulate, sparingly pubescent beneath, 2–4 in. long: fls. 5–9 in rather dense racemes, creamy white, very fragrant, on rather short pubescent pedicels; petals oval; style divided about one-half. May, June. S. E. Eu., Caucasus. B.B. 2:186.—This is the common Mock Orange, less showy than the following species and of somewhat stiff habit, but deliciously fragrant. There are several vars. in cultivation. Var. **argénteo-marginàta,** Hort. Lvs. edged creamy white, and other variegated forms. Var. **aùreus,** Hort. Foliage yellow. Var. **nànus,** Schrad. Dwarf, compact shrub, with dark green foliage; flowers but rarely. Var. **salicifólia,** Hort. Lvs. lanceolate or linear-lanceolate. There are also several vars. with double fls., as vars. **dianthiflòrus, multiflorus plènus, primulæflòrus** (R.H. 1870, p. 305), **rosæflòrus,** mostly of dwarfer habit than the type.

9. **Zéyheri,** Schrad. Probably hybrid of the preceding and *P. inodorus;* lower than *P. coronarius* and more spreading, with sometimes arching branches: lvs. ovate, usually rounded at the base: fls. usually 5, pure white, slightly fragrant or scentless, 1½–1¾ in. broad; style sometimes longer than stamens, divided one-half or less. June. Of garden origin. The different forms of *P. Zeyheri* are, besides those of the following hybrid, the most showy of the genus, bearing the large, pure white fls. in great profusion along the branches. *P. speciosissimus,* Hort., belongs here.

10. **Lemóinei,** Lemoine. Hybrid of *P. microphyllus* with *P. coronarius,* of varying habit: lvs. ovate to ovate-elliptic or ovate-lanceolate, usually pubescent beneath and ¾–2½ in. long: fls. 3–7 in short racemes, very sweet-scented; petals oval to oblong, mostly dentate at the apex. G.F. 2:617.—Some of the best forms of this hybrid are **Avalanche.** Graceful shrub, with slender arching branches, covered almost the whole length with showy white fls. G.C. III. 21:89. M.D.G. 1896:293. **Gerbe de Neige** is similar, but the fls. are larger. **Boule l'argent** has large, double fls. and the habit of *P. coronarius.* G.C. III. 18:19 and 23, suppl. 28 May. **Candélabre.** Low shrub, with upright branches covered with large fls. M.D.G. 1896:294. Var. **eréctus.** Upright, to 5 ft., covered with white fls. **Mont Blanc** is similar in habit, but fls. larger and showier.

BBB. *Fls. 1–3, occasionally 5.*

c. *Flowering branchlets 2 in. or more long, with 2 or 3 pairs of rather large lvs.: pedicels and calyx glabrous.*

11. **láxus,** Schrad. (*P. undulàtus,* Hort. *P. speciòsus,* Schrad.). Shrub, to 8 ft., with spreading slender branches: lvs. elliptic-ovate to oblong-lanceolate, entire or sparingly denticulate, often slightly recurved and pendulous, sparingly appressed pubescent beneath, 2–4 in. long: fls. oftener solitary, scentless, 1–1½ in. across; style as long as stamens. May, June. S. C. to Tenn. and Fla. B.R. 2:186. Gng. 8:340.—This species is closely allied to the following, and perhaps best considered a mere variety of it.

12. **inodòrus,** Linn. (*P. grandiflòrus,* Willd.). Shrub, similar to the former, but usually more upright and more vigorous: lvs. broadly ovate to elliptic-ovate, usually dentate, bearded in the axils of the veins beneath, 3–5 in. long: fls. 1–3, occasionally 5, 1½–2 in. broad, scentless; calyx-lobes ovate-lanceolate, twice as long as ovary; style often longer than stamens. May, June. N. C. and Tenn. to Ga. B.R. 25:39 (as *P. laxus*). B.M. 1478. The *P. inodorus* of Gray differs in its smaller, often entire lvs. and smaller, usually solitary fls. with short ovate calyx-lobes.—Some forms of this species, and especially the preceding species, have proved tender north, but most are hardy.

cc. *Flowering branchlets usually 1 in. or less long, with rather small lvs.*

13. **hirsùtus,** Nutt. (*P. trinérvius,* Schrad.). Upright or spreading shrub, to 6 ft.: lvs. ovate-acuminate, serrate, pubescent above, grayish tomentose beneath, 1–2½ in. long: fls. 1–3, on short branchlets with usually 1 pair of lvs., creamy white, 1–1½ in. across, scentless; calyx pubescent; style short, with connate stigmas. N. C. to Ala. and Texas. Gn. 26, p. 375; 34, p. 138. S.B.F.G. II. 2:119. B.R. 24:14.—This species is less decorative than most of the others. It differs from all Asiatic and most N. American species by its winter-buds being not enclosed in the base of the petioles, while all others except a few southwestern species have the small winter-bud enclosed in the base of the petioles, and they are therefore not visible until the lvs. have fallen off.

14. **microphýllus,** Gray. Shrub, to 3 ft. high, with spreading slender or rigid branches: lvs. oblong-ovate, entire, appressed pubescent on both sides or almost glabrous, glaucescent beneath, ½–1 in. long: fls. 1–3, white, about 1 in. across, very fragrant; calyx glabrous or appressed-pubescent. New Mex. to Calif. and Colo. G.C. III. 2:156. Gn. 40:824. P.G. 5:109.—One of the most distinct species, deliciously fragrant; likes sunny, well-drained position.

P. acuminàtus, Lange, is hardly different from P. Satsumi, but lvs. larger and broader.—*P. Billàrdi,* Koehne (P. pubescens Souvenir de Billard, Hort.). Lvs. broadly ovate, pubescent beneath, large: fls. in many-fld. panicles, rather large; calyx pubescent. Origin unknown.—*P. Chinènsis,* Hort. = P. Satsumi.—*P. Columbiànus,* Koehne. Closely allied to P. Gordonianus, but lvs. smaller, with only 1–4 coarse teeth on each side. Calif.—*P. cordifòlius,* Lange. Closely allied to P. Californicus, but panicle very many-fld., leafy near the base. Origin unknown.—*P. Coulteri,* Wats. Allied to P. Mexicanus, but calyx and lvs. densely covered with grayish pubescence. N. Mex. G.F. 1:233.—*P. floribùndus,* Schrad. Similar to P. coronarius: lvs. more pubescent beneath, fls. larger and less fragrant. Probably hybrid of P. pubescens and P. inodorus.—*P. Godohòkeri,* Kirchn. = P. hirsutus; but also P. laxus is sometimes cult. under this name.—*P. Kochiàuus,* Koehne, is a form of P. Zeyheri, with the style exceeding the stamens.—*P. Mexicànus,* Schrad. Half-evergreen shrub with spreading branches, allied to P. hirsutus: lvs. sparingly pubescent: fls. 2 in. across, fragrant: stigmas not connate. Mex. to Guatemala. B.R. 28:37. R.H. 1852:381. G.C. II. 19:753. B.M. 7600. Not hardy north.—*P. Nepalènsis,* Koehne. Allied to P. Pekinensis: lvs. broader, pubescent in the axils of the veins beneath; petioles not purplish. Himalayas.—*P. Schrènkii,* Rupr. Allied to P. coronarius. Upright.: lvs. large and thin: fls. scentless, smaller; style appressed pubescent at the base; petals narrow. Manchuria.—*P. tenuifòlius,* Rupr. Allied to P. coronarius: with slender spreading branches: lvs. almost glabrous, thin: fls. small, scentless; petals narrow. Manchuria, Amurland.—*P. tomentòsus,* Wall. Allied to P. coronarius: lvs. pubescent on both sides, tomentose when young. Himalayas.—*P. umbellàtus,* Koehne Probably hybrid of P. inodorus and P. coronarius, or an allied species: fls. in broad 2–15-fld. panicles, compound of long-peduncled cymes. Origin unknown.—*P. verrucòsus,* Schrad. (P. pubescens, Koch, not Loisel.). Allied to P. pubescens, but bark brown: Fls. smaller. Origin unknown.

ALFRED REHDER.

PHILAGÈRIA. Consult *Lapageria* and *Philesia.*

PHILÉSIA (Greek, *lovely*). *Liliàceæ.* A member of the lily family with the general appearance of some common northern shrub is certainly an extraordinary thing. Philesia is such a shrub, growing 3–4 ft. high, near the Straits of Magellan, and bearing showy pendulous, red, Lapageria-like fls. about 2 in. long. It is far removed from the ordinary lily types with 6 similar perianth-segments, for it has a distinct calyx of 3 sepals and 3 petals. It is closely allied to Lapageria, but differs in habit, in the calycine character of the outer perianth and the monadelphous stamens. This plant is very rare in cultivation. It is said to live outdoors in the most favored localities of England and Ireland.

Magellánica, J. F. Gmel. (*P. buxifòlia,* Lam.). Much branched: lvs. alternate, linear-oblong, 1–1½ in. long, leathery, evergreen, feather-veined, glabrous, glaucous beneath; margins reflexed; petiole jointed at the junction of the blade: fls. solitary, bright rosy red; petals wavy; filaments united into a tube below the middle, then free: ovary 1-celled, with 3 short parietal placentæ which bear several ovules: fr. a berry. B.M. 4738. F. 1854:65. G.C. II. 18:105.

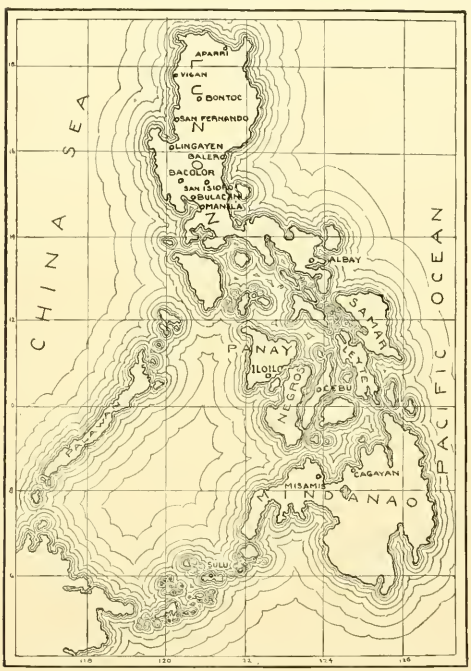
W. M.

Philesia is too slow-growing ever to become very popular. The undersigned cultivated this plant more than 20 years ago, but has not seen a specimen of it for many years, and does not know where to find one at the present time. It is a short-jointed, hard-wooded shrub, with rather leathery, box-like leaves, and will grow to about 4 feet in height in time. It is an Andean species closely related to Lapageria, which fact will account for that bigeneric hybrid known as *Philageria Veitchii.* Philesia is said to be found from Chile down nearly to the Straits of Magellan, and should, therefore, be nearly or quite hardy. In the writer's experience with it this plant was grown in a Camellia house, in which a night temperature of 45° was maintained, the plants being firmly potted in a light, peaty soil. It flowered but sparingly in the latter part of the summer. The flowers were borne only singly in the axils of the leaves. Cuttings may be rooted when taken from ripened growth, but require careful management in a cool temperature, and are usually several months in rooting. If one tries to grow Philesia in too high a temperature the general result is a good crop of thrips and a case of general debility, much as with *Pernettya mucronata* under similar conditions. The writer does not consider Philesia extraordinarily hard to manage, provided it is kept cool and in a dewy atmosphere, but it will positively rebel against forcing.

W. H. TAPLIN.

PHILIPPINE ISLANDS, HORTICULTURAL CAPABILITIES OF. Fig. 1750. The Philippine Archipelago occupies about 700 miles of longitude and 1,000 miles of latitude (from 4.40° to 20° north lat., and from 116.40° to 126.30° east long.), just across the China Sea from the mainland of Asia. The equatorial current passes its southern border, the Kuroshiwo originates near the northern limit, the eastern portion is influenced by the Pacific drift, and over the whole the summer monsoon bears its rain-laden clouds. Of the 1,200 or 1,300 islands constituting the group, many are scarcely more than mountain peaks thrust above the sea, and less than 30 have an area worthy of special consideration. In general the mountains bear in a northerly direction and rise to such height as to materially influence the rainfall. The mountains are not, in the main, abrupt and forbidding, but the elevations are gradual and deeply indented with valleys, affording innumerable fertile plats along the slopes. The area of the islands is given as 114,356 square miles, of which a large percentage is arable. Luzon has about 36 per cent of the total area and Mindanao 29 per cent. The temperature is not extreme and is remarkably uniform on the islands of the archipelago. The observatory at Manila reports that the average temperature of December—the coldest month—for the 17 years prior to and including 1896 was

77°, and for May—the warmest month—82.9°, while the mean temperature during that period was 80.42°. The rainfall averages for February .46 in. For the 5 dry months, Dec., Jan., Feb., Mar. and Apr., the total average is 5.47 in., and for the 6 wet months, June, July, Aug., Sept., Oct., and Nov., the total average is 65.65 in. Observations show that the islands differ from one another but slightly in temperature, while there is considerable variation on the same island due to altitudes. Portions of Luzon are cool the entire year. Upon the basis usually allowed in tropical countries for decrease in temperature due to elevation, an elevation of 5,000 ft. would give an annual mean of 60.42°. There are tablelands where the mean would not be over 70° F. Different portions of the same island show also wide divergence in rainfall owing to mountain ranges.



1750. Philippine Islands, to show the general form of the archipelago.

The soils are quite varied, including not only all the grades from sandy to stiff clay, but limestone, slaty, volcanic, alluvial, etc.

While the Philippines are adapted by climate and soil to the production of almost everything that can be grown in the tropics, the Spaniards, pursuing their usual policy, limited their production to very narrow lines. North Luzon, including the extensive valley of the Rio Grande de Cagayan and its affluents, was chiefly devoted to tobacco; the low, flat, clay loam lands east and north of Manila, including most of the provinces of Manila and Bulacan and a portion of Pampanga, is farmed in rice. To the south of Manila the provinces of Batangas, Cavité and Laguna produce considerable coffee; while the long, irregular promontory forming the southeast of Luzon, with its moist, volcanic soils, is the hemp region. Some of the smaller islands south of Luzon, particularly Masbate and Ticao, produce hemp principally. Large quantities of sugar are produced in Luzon, chiefly on the sandy loam and alluvial lands in the provinces of Pampanga, Cavité and Laguna, though sugar estates may be found in nearly all portions of this island. Sugar is the principal product of Panay, Negros and Cebu. The following report of the principal exports of the Philippines for 1897 gives a condensed statement of the present agricultural situation:

Manila hemp	$8,571,850
Sugar	6,911,535
Coffee	45,648
Tobacco and cigars	2,128,380
Cocoanuts and copra	2,687,978
Sapan wood	23,323
Indigo	50,825
Liquid indigo	21,554
Ylang Ylang oil	24,937
Candlenut oil	15,755
Candlenuts	19,464
Copal	22,562
Fruits	8,393
Aloe fiber	13,687
Sesame	2,592
Betel-nuts	382

The principal cereals that can be produced are rice, corn, barley and tropical wheat. The general plan for producing rice is very crude. The rice is planted in a seed-bed, properly prepared, the last of April. The fore part of June, after the rainy season has saturated the soil, the native takes his water buffalo and plows a small field, previously surrounded by a levee. The water and soil make a thin mud; into this he sets the rice plants from a seed-bed, or he occasionally sows his rice broadcast. The heavy succeeding rains flood the field and perfect the crop, which usually matures and is harvested in December. At harvest the rice is hand-cut with an implement similar to a corn hook, but lighter. The rice is bound in small bundles, and when partially dry is laid upon the levees in ricks with the heads hanging over the bank. When cured the grain is removed with the hatchel or by tramping.

There are large areas adapted to the production of maize, but the Indian rarely gives much attention to cultivation; hence the results are small, except upon new lands. With more knowledge of the maize plant and with more industry it should be a profitable crop. Barley and glutinous wheat are winter crops, suited to the climate and well adapted to supplement the food supply. Limited quantities of beans are produced. It is not probable that any of the cereals will be raised in surplus quantities, sufficient for export. Fiber material, sugar, tobacco, fruits and nuts will continue to be the leading exports, with a rapid increase of the last two, under American control.

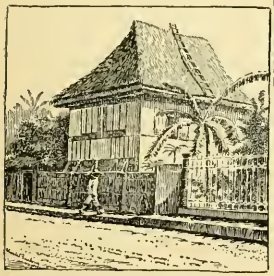
The Philippines are more celebrated for their fiber than for any other product. The best known is Manila hemp (*Musa textilis*), though there is some export of Aloe fiber (maguey) and pineapple cloth (piña). Manila hemp grows luxuriantly on the rich volcanic soils of the southern Luzon peninsula. It belongs to the same family with the banana, and its growth is similar. The trunk is 8–10 in. in diam. and is formed entirely of concentric leaf-stems or petioles. It is 8–10 ft. high at maturity. It is renewed by offshoots that spring from the base of the old plant, which are also used to set new fields. One setting of a plantation is good for ten years. As soon as the trunk is mature it is cut and each of the thick, fleshy leaf-sheaths of which it is composed is removed. The leaf-stem is then placed on a bench; a bar of wood with teeth on the under side is firmly pressed upon it while two men pull the stem, scraping the pulpy material from the fiber. The fiber is then hung up to dry. Four men will clean 150 pounds

or fiber, worth $12, per day. They receive one-half for cleaning.

Vegetables.—The great variety of vegetables that can be grown in the Philippines and the constant supply that might be had from a well-tended garden, indicate the source from which the people should obtain their principal food. As far as can be observed, gardening is not especially in the line of the Filipino. The Japanese accomplish marvels in gardening by the use of human excreta, both solid and liquid; the Filipino has, in addition, the excreta of the water buffalo, but he rarely has what can be properly called a garden. He may have small patches of beans, sweet potatoes and taro, but nothing approaching a garden, except cultivated for the city market. The traveler in the Philippines is impressed with the high culture of the people along some lines and their total lack in others. Gardening is one of their deficiencies, and it is the more surprising from their proximity to China and Japan. The following well-known vegetables are produced in the islands:

Beans of many varieties, beets, carob bean, celery, cabbage, cassava, carrot, cucumber, eggplant, garlic, gourd, lettuce, lentil, muskmelon, onion, okra, pumpkin, pea, pepper of all kinds, peanut, potato, radish, sesame weed, sweet potato, turnip, taro, tannier, tomato, watermelon, yam.

Fruits.—The banana, fruit of *Musa sapientum* (Figs 187, 188), is abundant in all portions of the islands. Except on the coffee plantations it is mainly produced close to the native huts, where it supplies shade and furnishes food. The principal variety sold in the local markets is the Guinea. The fruit of this variety is 4–5 in. long, peeling thin, flesh rich, yellow and firm, mainly eaten fresh. The plantain (*Musa paradisiaca*) may be treated in the same connection. It is larger and a more vigorous producer than the banana and is usually eaten cooked. With rice it constitutes the principal food of the Filipino. First it is produced with little labor, an important consideration in tropical countries; second, it adds an agreeable flavor to the rice; third, it ripens almost continuously throughout the year; fourth, it produces more food per acre than any other fruit or any cereal. Cases are reported in which 40,000 lbs. of the edible portions of the plantain have been produced per acre. This would give nutritive material per acre as follows: proteiu, 520 lbs.; fat, 240 lbs.; carbohydrates, 8,400 lbs. Fifteen hundred lbs. of cleaned rice per acre (larger than any Philippine crop) would furnish protein 120 lbs., fat 45 lbs., carbohydrates 1,182 lbs. The plantain is dried and ground or pounded into flour for food. To transport bananas and plantains to the United States would require steamers with some refrigeration, or the fruit would be too ripe on arrival.



1751. Typical house near Manila.
Roof made of the Nipa Palm.

1752. A typical laborer's hut in Manila.
Also made of Nipa Palm,—a *casa de nipa.*

The coffee plant, *Coffea Arabica* (Fig. 514), grows luxuriantly in the sheltered ravines of the mountains of the entire group; but the principal portion for export is grown in Cavité, Batangas, Laguna and in the mountains bordering the western coast of Luzon. In flavor it is similar to the Java and is highly prized in the markets to which it has been shipped. There is a variety of coffee produced in Mindanao called Zamboanga. It has a larger berry than the Manila and is not so highly prized. Its principal market is Singapore. Coffee-growing requires high-class agriculture, and for this reason it has never flourished in the Philippines as the climate and the conditions warrant. Several things should be carefully observed in coffee-farming: the young plant should be root-pruned and transplanted once or twice before final setting in the orchard; holes 2½ ft. square and 2 ft. deep should be dug and filled with soil, for each plant in the permanent orchard—holes 8 ft. apart; coffee trees should be pruned annually; the shade trees or plants should not be such as will draw heavily upon the soil and should not be so dense as to give more than a partial shade. The best and the poorest coffee are the product of the same tree, hence the necessity of great care in production and grading. With a full development of the coffee industry the Philippines probably could supply the entire annual imports of the United States (831,827,063 lbs. in 1899) to the mutual profit of both countries.

1753. A hay (rice grass) carrier in Manila.

Oranges, lemons and limes are produced abundantly. They are, however, of an inferior quality, due to variety and lack of cultivation and of pruning. The orange trees are exceedingly healthy and vigorous. In the hands of the Filipino the orange is practically a product of nature. No effort has been made to improve the fruit by the general introduction of better varieties, nor to improve the quality by selection, cultivation, fertilization and pruning. There is scarcely any limit to the supply of this luscious fruit that could be produced annually if science and industry should be directed to planting it upon the elevated tablelands of these islands. The soil on large areas is well adapted to the citrous fruits. The abundant rainfall during the fruit-growing season and the dry weather during the period of ripening, are conditious that will not be overlooked by the intelligent horticulturist in the future. What has been said of oranges is equally applicable to lemons, limes and grape fruit.

The shaddock, *Citrus Decumana*, of which grape fruit or pomelo is the best variety, is a native of the Malayan and Polynesian islands and is at home in the Philippines. This fruit sometimes attains great size (15 lbs.), but is too coarse for commerce. The demand for the large, juicy, subacid pomelo has always been much in excess of the supply, and this, if it could be obtained abundantly, would rank in consumption with oranges and lemons. See *Citrus* and *Pomelo.*

Pineapple, the collective fruit of *Ananas sativus* (Fig. 83), finds a congenial habitat on the sandy coast lands and in the warm, rich valleys of these islands. Under these conditions the plant with care attains large size and the rich, saccharine juice develops its highest flavor. The pineapple is propagated by setting the

suckers, which spring from the base, in rows 4 ft. apart and 2 ft. in the row. This requires about 5,000 plants per acre. It bears fruit in 18 to 20 months. Carefully cultivated the fruit should weigh, on an average, 6–8 lbs. Occasionally specimens are found weighing 16 lbs. There are many cultivated varieties and they vary much in size and quality. With encouragement it would soon become an important branch of commerce. Up to this time they have been grown simply for home consumption and for the exquisite fiber, sometimes called "pineapple silk," obtained from the leaves.

Guava, fruit of *Psidium Guava*, has been acclimatized and finds genial conditions. The beauty of the tree, the fragrance of the flowers and the utility of the little, subacid, juicy fruit, make it a favorite garden tree wherever it can be grown. Its excellence for jelly is known, but it has not yet attained commercial importance in the Philippines. See *Guava* and *Psidium*.

Chocolate bean, fruit of *Theobroma Cacao*, is a small tropical evergreen, bearing an elongated, egg-shaped fruit 5–10 in. long, containing numerous seeds the size of a chestnut, imbedded in a sweet pulp. These seeds are known in commerce as chocolate beans, and both in the green and dry state are used by the natives as food. They contain about 50 per cent of oil and have an agreeable flavor. For manufacture, the seeds, after the removal of the husk, are roasted, then ground into an oily paste which is mixed with sugar and flavored, forming the chocolate of commerce. As yet, the bean has been produced in a limited quantity, but the industry could be developed into a large business. See *Theobroma*.

All the spices are at home in these islands. Allspice, fruit of the *Pimenta officinalis* (Figs. 1804–5), a beautiful evergreen, attaining a height of 30 ft.; nutmeg, fruit of the *Myristica fragrans* (Figs. 1452, 1453), a

1754. Ylang ylang, yielding a famous oil (×⅔).

bushy evergreen 40–50 ft. high; and ginger, the rhizome of *Zingiber officinale* (which see), a perennial plant, reed-like, with annual stem 3–4 ft. high, have been tested and are or can be produced in the islands. Cinnamon, inner bark of *Cinnamomum Zeylanicum*; cloves, the fruit of *Eugenia caryophyllata* (Fig. 500), a beautiful evergreen 15–30 ft. high; and pepper, the fruit of *Piper nigrum*, a short shrub, find a natural habitat in Mindanao and the Sulu group. Spices to the amount of $2,782,301 were imported into the United States in 1899, all of which could be supplied by the Philippines under a proper development of this industry.

Vanilla, *Vanilla planifolia* (which see), is a climber. It has a long, fleshy pod with numerous seeds, from which are obtained by fermentation the vanilla of commerce. It commences to bear at 3 years old and continues for 30 years or more. In 1899, the value of $1,235,412 was imported into the United States. This plant can be grown luxuriantly on all the Visaya and Sulu islands.

Cocoanut palm, *Cocos nucifera* (Figs. 506, 507, 1497), is an almost universal coast product of these islands. Its certain germination, vigorous growth, number of months in fruitage, and long life without cultivation, give it value in the estimation of the natives. The tree in full bearing produces about 150 nuts annually and continues in fruit nearly the entire year. The fiber of the thick husk enveloping the nut is manufactured into cordage, matting, brushes, bags, etc.; the shell of the nut is made into drinking cups; the kernel or meat of the nut is manufactured into sweetmeats or becomes the copra of commerce; the pint or quart of sweetish liquid in the center of the nut is used for drink, fresh or fermented. For copra, the ripe nuts, after gathering and removing the husk, are allowed to remain in the sun till the milk is dissipated and the kernel shrinks from the shell. The shell is then broken and the meat, further dried, becomes the copra of commerce. This is largely transported as ballast to Europe, where the oil is expressed. In 1897 the export of copra from the Philippines amounted to 113,178,240 lbs., and this amount could be increased indefinitely to meet the demands of trade without trenching upon other products.

Ylang ylang, *Cananga odorata* (Fig. 1754), a native of the Philippines, is a tall tree with large, generally drooping, yellow flowers, from which is obtained the oil of commerce. The average annual export from 1886 to 1890 was $21,937, used by perfumers.

Candlenut or candleberry—the fruit of *Aleurites triloba*, a tree 30–40 ft. high,—is exported in considerable quantities, averaging about 16,000 lbs. annually. The berry, when dry, burns—hence called candlenut. The oil has the property of drying rapidly, and is used by artists.

Betel-nut, the fruit of the Areca palm, *Areca Catechu*, is about as large as a hen's egg. When the tough, fibrous shell is removed, a nut about ¾ in. in diameter, having an albuminous rind, remains. This is chewed to aid digestion and sweeten the breath. It is supposed to strengthen the gums. Previous to chewing, it is boiled and wrapped in a betel-leaf with a small quantity of lime. The annual export has not averaged more than 300–400 lbs., mainly to India.

Many fruits, valuable only for home consumption, are produced in the Philippines. The best known of these are bread-fruit, custard apple, mango, mangosteen and mulberry.

Bread fruit, fruit of *Artocarpus incisa*, is found in all of the principal islands. It is about 6 in. in diameter. When nearly ripe it is gathered and baked. The crust is then removed and the farinaceous pulp is eaten alone or with cocoanut milk. If mashed, packed in a bundle and covered with earth, it undergoes a slight fermentation at first, which soon ceases, and it will then keep for some time. In some islands it is one of the principal foods.

Custard apple, fruit of *Anona reticulata*, a large, dark brown fruit with a soft, creamy pulp like custard, must be eaten soon after it ripens. This variety was introduced by the Spaniards.

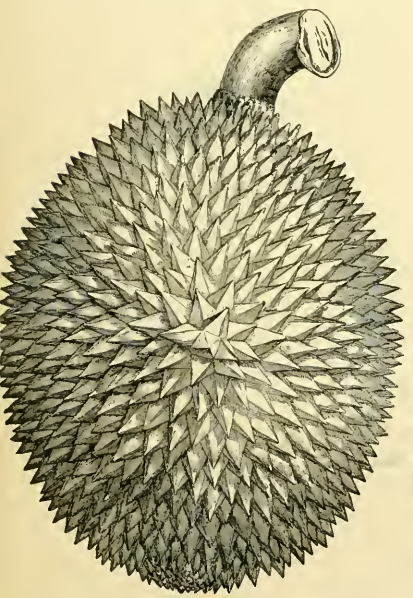
The mango, fruit of *Mangifera Indica* (Figs. 1360, 1361), a large, spreading ornamental tree, is about 3 in. long and generally obovate, flattened on one side—light yellow when ripe. The flesh is subacid, rich and juicy, somewhat fibrous, attached to a large stone in the center. There is a slight turpentine flavor, not observed after a taste for the fruit has been acquired. The tree is a constant and prolific bearer, which, with its value and beauty as a shade, makes it a desirable home tree, especially with the better class of people. It is abundant in uncultivated places. The fruit is picked when partially ripe and made into sweet pickles or is preserved, but it is principally eaten in the natural state.

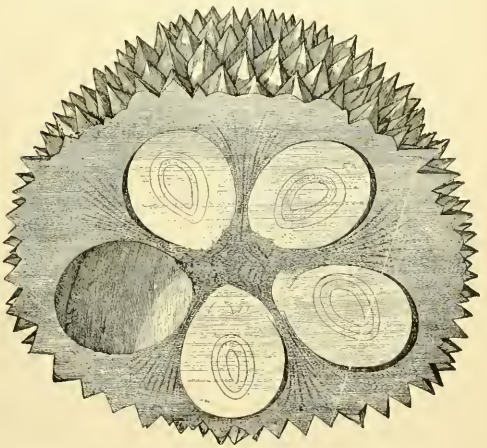
The mangosteen, fruit of *Garcinia Mangostana* (Fig. 893), is esteemed the most delicious of the oriental fruits. It is about the size and shape of the apple, with

a rind like a pomegranate. The interior is divided by thin partitions into cells, which contain the seeds surrounded by a white or red juicy pulp of a most delicious flavor, combining the finer qualities of the strawberry and the grape. Unfortunately this fruit is too delicate for transportation. In addition to its use as a hand fruit the pulp is preserved or fermented.

The mulberry, both white and black, is grown in Luzon, but it has not attracted the attention which its valuable wood and abundant fruitage warrant.

Tamarind, known as Manila tamarind (fruit of *Pithecolobium dulce*), was introduced from Mexico. The





1755. Fruit of the Durian, exterior view and cross-section. Reduced one-half from a plate of "a middle-sized" specimen.

sweetish subacid pulp, inclosing its seed, is boiled and eaten, is made into a cooling drink or is preserved in sugar. The tree is valuable for shade and for timber, and is noted for the fragrance of its flowers.

The sapodilla plum, fruit of the *Achras Sapota* (see *Sapodillo*), a small, somewhat acid fruit, becoming very sweet when overripe, is cultivated to some extent.

The Mammee apple or South American apricot, fruit of *Mammea Americana* (Fig. 1354), is produced in a limited way. The fruit is yellow, 5–6 in. in diam., rind and pulp near the seeds bitter, intermediate portion sweet, aromatic and agreeable.

Grapes can be grown successfully in some of the drier parts of the islands, and there is no doubt of the success of the strawberry and the blackberry in some localities.

Importation of tropical fruits into the United States in 1899, much of which could soon be supplied by the Philippines with proper encouragement:

Coffee	$55,475,470.00
Cocoanuts, copra and figs	5,985,905.00
Bananas	5,665,588.00
Lemons	4,398,004.00
Oranges	1,097,596.00
Spices	2,782,301.00
	$75,204,864.00

S. A. KNAPP.

Additional Notes on the Products of the Philippines.— The land in the Philippines is seldom given good attention. Crops are planted in the easiest possible way and allowed to grow about as they will. Plows of a modern make were two years ago unknown there. The natives utilize a crooked limb or a rudely made wooden contrivance to scratch the ground. Probably the production of sugar will be the first to increase under American control. There are only a few *haciendas* or plantations with anything like modern sugar-making machinery. Fully 30 per cent, it is estimated, is lost in the crude processes generally employed. There is no sugar refinery in the islands. The establishment of one would greatly stimulate production. The island of Negros is ideal for sugar production.

Hemp is the most developed industry in the Philippines. The cocoanut industry is fairly well developed. We may also look for remarkable growth of the cultivation of the plant from which rubber is made. Mindanao and the southern islands are especially fitted for it, so experts say.

Our own grasses are seldom seen in the Philippines. Hay is never used. Rice grass is substituted, being harvested in bunches, the sod and soil attached. It is freshened with water before fed to horses and cattle. Spanish books say that cotton is grown to considerable extent in Ilocos provinces of northern Luzon. Strawberries can be found in the higher altitudes of Benguet province. It is said that all efforts to cultivate the rose in the Philippines have failed. More than thirty varieties of bananas are grown in the Philippines, some of which are superior to any in our own markets.

FRANK E. GANNETT.

Circular No. 17 of the Div. of Bot., U. S. Dept. of Agric., contains 8 pp. of notes on the plant products of the Philippine Islands.

A most remarkable fruit of the Philippines and other parts of Malaya is the durian, shown half size in Fig. 1755 (reduced from plates in vol. 7 of the Trans. of the Linn. Soc., illustrating Charles König's account of the fruit). It is the *Durio zibethinus* of botanists, one of the Malvaceæ. The reader may find an entertaining account of this fruit in Alfred Russel Wallace's "Malay Archipelago," chapter 5. It grows on a "lofty forest tree, somewhat resembling an elm. * * * The fruit is round or slightly oval, about the size of a large cocoanut, of a green color, and covered all over with short stout spines, the bases of which touch each other,

and are consequently hexagonal, while the points are very strong and sharp." It has five compartments or cells filled with cream-colored pulp in which are imbedded two or three seeds the size of chestnuts. The liking for the durian is an acquired taste. "To eat durians," writes Wallace, "is a new sensation, worth a voyage to the East to experience."

PHILLYRÉA (its ancient Greek name). *Oleàceæ.* Ornamental evergreen shrubs, with opposite short-petioled, entire or serrate lvs , small white, usually fragrant fls. in axillary clusters and small berry-like, dark-colored fruit. Most species are hardy only South, but *P. decora*, the handsomest of all the species, is probably hardy in sheltered positions as far north as New York. The Phillyreas may be used in the southern states and Calif. for evergreen shrubberies in drier and more exposed localities. They grow in almost any soil and prefer sunny positions; *P. decora* alone seems to grow better if partly shaded. Prop. by seeds and by cuttings of half-ripened wood under glass in summer or by layers; they are also sometimes grafted on *Ligustrum ovalifolium*. Five species in the Mediterranean region. Lvs. entire or serrulate, thick and leathery, quite glabrous: fls small, in axillary short racemes; calyx 4-toothed; corolla 4-lobed, with short tube; stamens 2, with very short filaments; style shorter than tube: ovary 2-celled· fr a 1-seeded black drupe.

A. *Lvs. ¾–2 in. long: fr. small.*

latifòlia, Linn. Shrub or small tree, to 30 ft., with spreading, somewhat rigid branches: lvs. ovate or oval to ovate-oblong, rounded or slightly cordate at the base, dark green and shining above, pale beneath, ¾–1½ in. long· fr. globose, conceave at the apex. May, June. S. Eu., N. Afr. There are several varieties. Var. **lævis**, Ait. Lvs. ovate, almost entire or slightly serrulate. Var. **rotundifòlia**, Arb. Kew. Lvs. broadly ovate or roundish ovate. Var. **spinòsa**, Ait. (*P. ilicifòlia*, Willd.). Lvs. ovate or ovate-oblong, sharply serrate.

mèdia, Linn. Spreading shrub, to 20 ft.: young branchlets pubernlous: lvs. oblong-ovate to ovate-lanceolate, entire or serrate, dark green and shining above, ¾–2 in. long: fr. ovoid, pointed. May, June. Mediterranean region.—The most important of the many varieties are the following: Var. **buxifòlia**, Ait., with oblong-ovate, obtusish lvs. Var. **oleæfòlia**, Ait. (*P. oleæfòlia*, Hort.). Lvs. oblong-lanceolate, almost entire; branches erect. Var. **péndula**, Ait. Branches spreading and somewhat pendulous: lvs. lanceolate.

angustifòlia, Linn. Spreading shrub, to 15 ft., with glabrous branchlets: lvs. oblong-lanceolate to linear-lanceolate, dull green above, 1–2 in. long: fr. globose or ovoid-globose, pointed. May, June. Mediterranean region. Var. **rosmarinifòlia**, Ait., has linear-lanceolate lvs., sometimes over 2 in. long, and erect branches. The 3 preceding species are very closely related to each other and considered by some botanists to be varieties of ouly one species.

AA. *Lvs. 3–5 in. long: fr. ½ in. long.*

décora, Boiss. & Bal. (*P. Vilmoriniàna*, Boiss. & Bal. *P. laurifòlia*, Hort. *P. Medwèdewi*, Sred.). Shrub, to 10 ft., with spreading branches: lvs. oblong to oblong-lanceolate, acuminate, usually entire or remotely serrulate, dark green and shining above, yellowish green beneath: fr. oblong-ovoid, purplish black. June, July. W. Asia. B.M. 6800. G.C. III. 4:673; 16:369. R.H. 1889, p. 199; 1895, p. 204, 205. M.D.G. 1898:349. S.H. 2·523. Gn. 24, p. 490. ALFRED REHDER.

PHILODÉNDRON (Greek compound for *tree-loving*). *Aràceæ.* Shrubby or tree-like, with short internodes, usually climbing, rarely arboreous: leaves from entire to bipinnatifid. Differs from Schismatoglottis in floral characters. The flowers are monœcious, on spadices, with no perianth, the sterile with 2–6 stamens united into a sessile obpyramidal body, the pistillate fls. with a 2–10-loculed ovary and some staminodia, the berries inclosed in the involute spathe. The species are all tropical American. They are monographed by Engler in DC. Phaner. Monogr. 2:355 (1879), and more recently by the same author in Botanische Jahrbücher 26:509 (1899). In the latter, 167 species are accepted

Only a few Philodendrons can be grown to have an ornamental appearance in a small state. One which goes under the name of *P. elegantissimum*, with finely cut leaves, makes a good pot specimen, although it will reach a good height where suitable opportunities are afforded. The same may be said of *P. Selloum*, a beautiful species with pinnatifid leaves. The arborescent kinds should have a very porous rooting medinm and copions supplies of water while in active growth. When climbing they must have provision made for the roots, which are produced along the stems. Some of the species do well climbing up the stems of tall palms, such as Arenga and Livistona; otherwise dead trunks of tree ferns make admirable rooting substances for the roots to penetrate and cling to. Propagation is by division of the climbing stems. *P. elegantissimum* is an unidentified trade name.

A. *Leaves bipinnate.*

B. *Terminal leaf-segment 3-lobed, the lobes unequal.*

Sellòum, C. Koch (*P. Sèllowi*, Hort.). Blade pinnatisect, the segments again pinnate or lobed; terminal segment 3-lobed, the cuspidate middle lobe about equaling the obtuse lateral ones; spathe slightly cuspidate, its tube longer than the ovate hooded blade, green without, white within. Distinguished from *P. bipinnatifidum* by the very numerous parallel translucent spots, which are visible on both sides of the leaf and are often excurrent on the margin. Brazil to Paraguay.

BB. *Terminal leaf-segment 3–5-lobed, the middle lobe much longer than the lateral ones.*

bipinnatifidum, Schott. Blade pinnatisect, the segments again pinnate or lobed: terminal segment 3–5-lobed, the middle lobe ovate-lanceolate, acute, much longer than the obtuse lateral ones; spathe oblong-ovate, its tube scarcely distinct from its blade, purple without, white within. S. Brazil.

AA. *Leaves simple.*

B. *Leaf-blade lanceolate.*

crassinérvium, Lindl. Climbing: lvs. lanceolate-acuminate, the midnerve very thick and inflated: spathe obtuse and hooded, apiculate at the tip. Brazil. B.R. 23:1958.—*P. nòbile*, Hort., is much like this and perhaps a form of it. It is larger: lvs. obovate-lanceolate: tube of spathe rosy crimson inside and outside, the limb white inside and spotted outside.

BB. *Leaf-blade sagittate.*

speciòsum, Schott. Stem tall, arborescent; petioles terete at the base, concavo-convex above, twice as long as the midrib; blade triangular-oblong-ovate, bright green, acuminate, deeply sagittate, the basal lobes rhomboidal, obtuse, abruptly narrowed on the inner side above the middle; spathes thick, green with purple margins; spadix finger-shaped, shorter than the spathe. Central Brazil.

BBB. *Leaf-blade oblong to ovate-cordate.*

C. *Color of leaf milky white above, with reddish veins.*

Sòdiroi, Hort. Lvs, cordate, ovate, milky white with reddish veins above; petiole cylindrical, pink. U. S. Colombia.

CC. *Color of leaves some shade of green above.*

D. *Petioles tomentose.*

verrucòsum, Mathieu (*P. Cárderi*, Hort.). Stem long, branching, climbing, ashy gray, scabrous, angular-cylindrical, swollen at the nodes; petioles stout cylindrical or somewhat angled, bright metallic red, covered with soft, erect, twisted, fleshy bristles and greenish hairs; blade glabrous, green above, brilliantly polished, or with paler lines and immersed nerves, bright green beneath with salmon-violet lines between the lateral nerves; ovate-cordate, the semicircular basal lobes one-third as long as the slightly undulate apical one. Internodes of the stem 3–6 in. long: petioles 4–6 in.; blades 6–8 in. long, 4–6 in. wide. Veneznelan Andes. I.H. 18:79 (as *P. Duguense*).

DD. *Petioles glabrous.*

gigantèum, Schott. Climbing: petioles 3 ft. long, thick, cylindrical; blade cordate-ovate, 24–28 in. long, 16–20 in. wide, the basal lobes slightly introrse, semi-ovate or obliquely semicircular, one-fourth as long as the apical one, separated by a broad parabolic sinus; spathe tube 2 in. long, oblong, purple; spadix very thick. Trop. America.

Ímbe, Schott (*P. Sellowiànum*, Kunth). Branches rusty purple: petioles of young plant semicylindrical, terete, sparsely brown-spotted, 1½–2 times longer than the midrib; blade like parchment, cordate-oblong, the oblong basal lobes one-half as long as the apical, separated by a wide parabolic sinus, retrorse or sub-introrse; apical lobe cuspidate; spathe green outside, red within, its broadly ovate blade dirty yellow; spadix shaped like a finger. Rio de Janeiro.—According to Engler, the Mexican *P. sanguíneum* has been called *P. Imbe* in gardens. *P. sanguíneum* differs in having more elongated lvs. which are red beneath.

spectábile, Linden. Large, of vigorous habit: lvs. 12–15 in. long, nearly as broad, silky or velvety green. Hab.?

Andreànum, Devans. Lvs. rather large, cordate-ovate, with short basal lobes, bronzy green. Colombia. R.H. 1886:36.—Sparingly grown. Looks like a narrow-lvd. Anthurium.

P. Devansayànum, Lind., is a scandent species with rather small glossy green lvs. which, even to the petioles, are blood-red when young. Peru. I.H. 42:48.—*P. Glaziòvii*, Hook. f., is a climber something like P. crassinérvium: lvs. oblong-acute, deep green, 12–18 in. long, 3–5 in. broad: spathe open, yellowish, crimson within the tube. Brazil. B.M. 6813.—*P. imperiale* is mentioned in European trade lists. Engler accounts for only one P. imperiale (of Schott) and that he makes a synonym of P. asperatum, Koch. Sander & Co. advertise P. imperiale, var. Laucheana: "a lovely trailing stove foliage plant, which is admirably adapted for growing on pillars or wire shapes. It is quite distinct from and greatly superior to the well known P. imperiale. The habit is much more graceful, the heart shaped foliage smaller and more elegant. Down the center, from either side of the broad light green midrib, extend irregular blotches of dark green, projecting into a clear glaucous color, the edges of which are relieved by green blotches. The bases of the petioles bear bright red and green phyllodes." P. asperatum is a short-jointed climbing Brazilian species with cordate-ovate entire dull green lvs.—*P. Mámei*, André. Lvs. cordate-ovate, acute, variegated with white: spathe partly open above and whitish, the tube blood-red. Ecuador. R.H. 1883, p. 104; 1883:492; 1897, p. 573. I.H. 43:66.—*P. pertúsum* is Monstera deliciosa.

JARED G. SMITH and G. W. OLIVER.

PHLEBÓDIUM (Greek, *a vein*). *Polypodiàceæ*. A genus of ferns related to *Polypodium* and sometimes united with it, but differing widely in the venation, which is broken up into ample areolæ, each of which contain 2 or more free veinlets which bear the sori on their united tips.

aùreum, R. Br. (*Polypòdium aùreum*, Linn.). Lvs. 2–3 ft. long rising from large, scaly wide-creeping rootstocks; divisions 5–9 in. long, nearly an inch wide, with copious, large, bright yellow sori. A rich ornamental species from tropical America, with glaucous green leaves. In Florida it grows on palmettos.

P. glaùcum, var. *Mayii* or *P. Mayii*. See Phymatodes.

L. M. UNDERWOOD.

PHLÈUM (*phleos*, an old Greek name for a kind of reed). *Gramíneæ*. A genus of 10 species in temperate zones. Spikelets 1-fld., in a close cylindrical spike-like panicle: empty glumes 2, persistent, keeled, short-awned: fl.-glume shorter, delicate, awnless. Perennials.

praténse, Linn. TIMOTHY. HERD'S GRASS. Figs. 1756, 1757. Commonly cult. for hay and for pastures, either alone or in company with red clover or other grasses. It was introduced into Maryland about 1720, from Europe, where it is native, by Timothy Hanson, and hence called Timothy. The other name is said to come from a man by the name of Herd, who found it growing in New Hampshire and began its cultivation. It is better adapted for hay than for pasture, and for the latter is suited to temporary rather than permanent pasture.

A. S. HITCHCOCK.

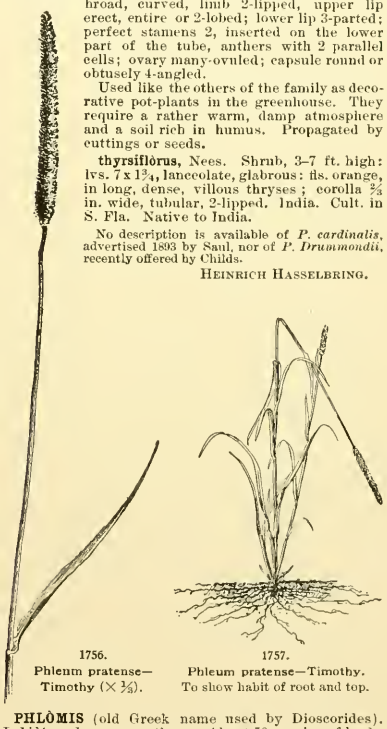
PHLOGACÁNTHUS (Greek for *flame*, and acanthus). *Acanthàceæ*. Tall half-shrubby herbs with entire or somewhat toothed lvs.: fls. white, red or greenish in long terminal or short lateral spikes; calyx 5-parted, segments linear, awnlike, acuminate; corolla-tube long, broad, curved, limb 2-lipped, upper lip erect, entire or 2-lobed; lower lip 3-parted; perfect stamens 2, inserted on the lower part of the tube, anthers with 2 parallel cells; ovary many-ovuled; capsule round or obtusely 4-angled.

Used like the others of the family as decorative pot-plants in the greenhouse. They require a rather warm, damp atmosphere and a soil rich in humus. Propagated by cuttings or seeds.

thyrsiflòrus, Nees. Shrub, 3–7 ft. high: lvs. 7 x 1¾, lanceolate, glabrous: fls. orange, in long, dense, villous thryses; corolla ⅔ in. wide, tubular, 2-lipped. India. Cult. in S. Fla. Native to India.

No description is available of *P. cardinalis*, advertised 1893 by Saul, nor of *P. Drummondii*, recently offered by Childs.

HEINRICH HASSELBRING.



1756. Phleum pratense—Timothy (× ⅓).

1757. Phleum pratense—Timothy. To show habit of root and top.

PHLÒMIS (old Greek name used by Dioscorides). *Labiàtæ*. JERUSALEM SAGE. About 50 species of herbs and shrubs native to the Mediterranean region with dense axillary whorls of rather large yellow, purple or white fls. Perhaps a dozen species have been cult., but they are rather coarse plants except for wild gardening and among shrubbery. They are of the easiest culture. The genus is placed by Bentham and Hooker next to Leonotis (Lion's Ear), which, however, has an excessively long upper lip. Phlomis plants are more or less woolly, and some of the species not cult. in America are conspicuously white-woolly. Lvs. all alike, or the uppermost reduced to bracts: whorls many- or few-fld.: fls. sessile; calyx usually plicate, truncate or with 5 equal teeth; upper lip of the corolla (galea) broad and compressed or strongly concave, rarely narrow and falcate; stamens 4, didynamous. The first three species described below belong to the section Euphlomis, in which the galea (upper lip of the corolla) is only shortly bearded and the lateral lobes of the lower lip are small and appendaged; the last species belongs to the section Phlomidopsis, in which the galea is long-bearded inside and at the margins and the lateral lobes of the lower lip are nearly as large as the middle one. *P. tuberosa* has run wild sparingly in the East. It is a vigorous and hardy species, propagating by subterranean tubers.

A. *Fls. yellow.*

B. *Plants shrubby: bracts not sharp and rigid at the apex.*

C. *Whorls 20–30-fld.*

fruticòsa, Linn. Shrub, 2–4 ft. high, divaricately much-branched: lvs. rounded or wedge-shaped at the base; bracts broadly ovate or ovate-lanceolate. S. Eu. B.M. 1843.—In the East it blooms from June to July. In S. Calif., according to Franceschi, it blooms in winter, and has the merits of withstanding drought and heavy sea winds. In New England it needs protection in winter.

CC. *Whorls about 16-fld.*

viscòsa, Poir. Lvs. truncate or subcordate at the base: bracts lanceolate-linear. Syria. Not in the trade, but inserted to show the differences between this and *P. Russelliana* as recognized by DeCandolle.

BB. *Plants herbaceous: bracts very sharp and rigid at the apex.*

Russellìana, Lag. Herb, 3–5 ft. high: lowest lvs. deeply cordate: whorls 40–50-fld. Syria. B.M. 2542 (as *P. lunarifolia*, var. *Russelliana*).

AA. *Fls. purple.*

tuberòsa, Linn. Herb, 3–5 ft. high: lvs. deeply cordate; lowest ones 6 in. or more long; floral lvs. 2–3 in. long, 6–8 lines wide: whorls 30–40-fld. S. Eu., eastern and northern Asia. B.M. 1555. W. M.

1758. Quedlinburg or Star Phlox.
A horticultural form of *Phlox Drummondii*. Natural size.

PHLÓX (Greek for *flame*, once applied to species of Lychnis). *Polemoniàceæ*. Phloxes are amongst the most satisfactory of garden plants. Their neat habit, bright-colored flowers, profuseness of bloom, and ease of culture make them favorites everywhere. The Phloxes are herbs, of about 30 species all North American (except perhaps one Chilean), although *P. Sibirica* also grows in Asiatic Russia. There are two classes of Phloxes, the annuals and the perennials. The annuals are derivatives of *Phlox Drummondii*, of Texas, which has now risen to first place as a garden annual. It has been immensely modified by domestication, so that the named garden varieties are numbered by scores. These garden forms differ in stature, color, size and shape of flower. Some are semi-double. An effort has been made to produce a yellow flower, but nothing nearer than a buff has yet been secured. The Phlox colors run to the cyanic series, and it is probable that a pure yellow is unattainable. *Phlox Drummondii* is of the easiest culture. This fact, together with the profusion and long season of its bloom, is an important reason for its popularity. It needs a warm, sunny place. It will grow even in poor soil, but in order to develop to its highest perfection it must have rich soil and the individual plants must be given room (say 1 ft. apart each way). Seeds are usually sown in the open as soon as the weather is settled; sometimes they are sown indoors, but the plants bloom so young that this is rarely practiced. If the ground is poor and dry, the plants usually cease blooming by midsummer, but if plant-food and moisture are abundant they may be expected to continue their bloom until late fall.

The perennial Phloxes comprise many species. *P. paniculata* and *P. maculata* have given rise to the common perennial Phloxes, whereas most of the other species are planted sparingly and have not been greatly modified by domestication. The garden perennial Phlox (of the *P. paniculata* and *P. maculata* type) is amongst the most showy of garden herbs. The terminal panicles have become 1 ft. long in some forms, and as densely filled as a hydrangea. The colors are most frequent in reds, but there are many purple, white, salmon and parti-colored varieties. This perennial Phlox should have a rich and rather moist soil if it is to be grown to perfection. Let each clump have a space, when fully developed, of 2–3 ft. across. The plants as purchased from nurseries usually do not come into full floriferousness until their third or fourth year. They will continue to thrive for several years with little attention, as is attested by the fine clumps of old-fashioned forms about homesteads. For the highest satisfaction in blooms, however, the plants should be relatively young or at least often renewed by dividing the clump. The stool gradually enlarges outwards. From the young, vigorous shoots on the outside of the clump the new plants should be reared, if one desires to propagate the variety to any extent. Old stools should be taken up every year or two, and divided and transplanted. This work is done in the fall, after the growth has ceased. By this process, the plants do not become weak and root-bound. Inferior and vigorous seedlings are often allowed to grow about the old plant, causing the named varieties to "run out." The perennial Phloxes usually bloom in early summer, but if the tips of the shoots are pinched out once or twice in early summer, the bloom may be delayed until late summer or fall.

Phlox is allied to Gilia and Polemonium. Some species are more or less shrubby at the base. The corolla is salverform, the lobes 5 and mostly obtuse, the throat narrow or nearly closed. The stamens are 5 and inserted on the corolla-tube, the anthers usually included in the tube. The fruit is a small capsule with 3 locules and few to several small usually flattish seeds. Leaves mostly opposite (upper ones sometimes alternate), entire. See Gray, Syn. Fl. vol. ii, pt. 1, p. 129.

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A. *Annual garden Phlox, pubescent, upper lvs. often alternate.*

1. Drúmmondii, Hook. Figs. 1758–60. Erect, branching, 6–18 in. tall: lvs. oblong-acute or lanceolate, the upper ones more or less clasping: fls. showy, in broad mostly flat-topped cymes, the calyx-lobes long and narrow and spreading or recurving in fruit, the corolla-lobes broad-obovate. Texas. B.M. 3441. B.R. 23:1949. —This is the common annual garden Phlox, now cultivated in numerous varieties, some of them having deeply cut petals (the "star" Phloxes). Fig. 1758. The seeds were received in England in the spring of 1835,

from Texas, having been collected by Drummond. In October of that year it was described and figured in Botanical Magazine, by W. J. Hooker, as *Phlox Drummondii*. The flower was described as "pale purple without, within, or on the upper side, of a brilliant rose-red or purple, varying exceedingly on different individuals in intensity, and in their more or less red or purple tinge, the eye generally of an exceedingly deep crimson." Lindley described and figured it in Botanical Register, 1837, describing the flowers as "either light or deep carmine on the inner surface of their corolla, and a pale blush on the outside, which sets off wonderfully the general effect. A bed of this plant has hardly yet been seen; for it is far too precious and uncommon to be possessed by any one, except in small quantities; but I have had such a bed described to me, and I can readily believe that it produced all the brilliancy that my informant represented." At the present time, *Phlox Drummondii* is one of the most popular annuals, and it has varied into many shades. *P. hortensiaflora*, *P. stellata*, *P. Leopoldii*, *P. grandiflora*, *P. Heynoldiana*, and many other names, belong here.

AA. *Perennial Phloxes of various habit, either pubescent or glabrous.*

B. *Flowering stems erect and usually stiffish.*

C. *Plant glabrous (exceptions in var. of No. 5).*

D. *Inflorescence large and thyrse-like: plants tall.*

2. **paniculàta**, Linn. (*P. decussàta*, Hort.). Fig. 1761. PERENNIAL PHLOX of gardens, in many forms. Plant stout and erect, 2–4 ft., glabrous: lvs. oblong-lanceolate and mostly tapering at the base: calyx-teeth awl-like. Woods, Pa., W. and S. B.M. 1880 (as *P. acuminata*).—The parent of the great number of perennial Phloxes of gardens, although some of these may be hybrids with the next. "Fls. pink-purple, varying to white," according to Gray. In cult. varying much in color.

1759. Phlox Drummondii. (×⅓.)

3. **maculàta**, Linn. Slenderer, usually with a spotted stem: lvs. very smooth and usually thicker than those of the above, the upper ones usually clasping: calyx-teeth short: fls. as in above. Range of the last, and in cult., but less important horticulturally than *P. paniculata*

1760. Phlox Drummondii. (×⅓.)

DD. *Inflorescence small and loose or flat-topped: plants lower.*

4. **ovàta**, Linn. (*P. Carolìna*, Linn. *P. triflòra*, Sweet). A foot or two tall, the stems erect from a short, decumbent base: lvs. narrow-ovate to oblong-lanceolate, the lower ones tapering to base and the upper ones somewhat clasping: fls. pink or light red, about 1 in. across, the straight or slightly curving tube twice or more longer than the rather short and broad calyx-teeth. Pa., south, mostly in elevated regions. B.M. 528.

1761. Phlox paniculata.

5. **glabérrima**, Linn. Fig. 1762. Differs in somewhat taller growth, linear-lanceolate to narrow-lanceolate, taper-pointed, firm, nearly veinless lvs. which have revolute margins, and in the narrow, very sharp-pointed calyx-teeth. Va. to Wis., and south.

Var. **suffruticòsa**, Gray (*P. suffruticòsa*, Willd. *P. nítida*, Pursh). Stiffer, sometimes pubescent above: lvs. considerably broader: fls. varying to flesh color. Ga. and Tenn., south and west. B.M. 2155 (as *P. carnea*). B.R. 1:68.

CC. *Plant distinctly hairy or pubescent (exceptions in No. 9).*

D. *Sterile, prostrate or running shoots arising from the base of the plant.*

6. **divaricàta**, Linn. (*P. Canadénsis*, Sweet). WILD SWEET WILLIAM. Stems slender, pubescent, 10–18 in. tall: lvs. varying from linear-oblong to ovate-lanceolate, mostly acute: fls. in small cymes terminating short branches, 1 in. across, blue or pinkish blue, handsome and somewhat fragrant, the corolla-lobes often notched, the calyx-lobes narrow and subulate. Woods and copses, in lowish grounds western Ontario, west and south. B.M. 163. G.F. 7:256.—A very attractive early spring flower, often coloring the fields in Michigan and other parts. Prefers rich soil.

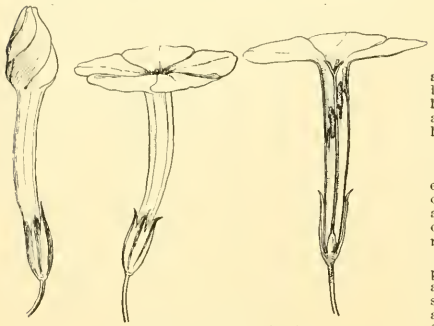
7. **réptans**, Michx. (*P. stolonífera*, Sims). Low and weak, the flowering stems reaching 6–12 in., the sterile ones long and prostrate, the plant thinly glandular-hairy: lvs. short-ovate or obovate, more or less obtuse: fls. few in each cyme, purple or violet, the lobes mostly entire, the calyx-lobes narrow and subulate. Pa. and Ky. to Ga., mostly in the upper regions. B.M. 563.

DD. *Sterile prostrate shoots none.*

8. **amœna**, Sims (*P. procúmbens*, Gray). Stems 6 in. or less high from a decumbent base, pubescent or hairy: lvs. numerous, mostly in rosettes at the base, few on

the flowering stems, small, oblong-lanceolate to linear-oblong, mostly obtuse but sometimes nearly or quite acute: fls. numerous for the size of the plant, purple, pink or white, the lobes usually entire, the calyx-lobes narrow and sharp-acute. Dry lands, Va. to Ky. and south. B.M. 1308.

9. **pilòsa**, Linn. (*P. aristàta*, Michx.). Stems slender but erect, 2 ft. or less tall, pubescent or hairy (nearly glabrous forms occur): lvs. small, linear or linear-lanceolate, widest near the base, acuminate: fls. numerous in rather loose cymes, varying through purple, pink and white, the lobes entire, the calyx-lobes awn-like. Dry fields, woods and prairies, British Amer. to Fla. and Tex., growing as far east as New Jersey. B.M. 1307. L.B.C. 13:1251.



1762. Phlox glaberrima (× 1¼).

BB. *Flowering stems diffuse and branching, often creeping, low: plants of more or less tufted habit.*

C. *Corolla-lobes 4-parted or very strongly notched.*

10. **bífida**, Beck. Low, the stems stiff and sometimes almost woody and often 1 ft. long and rising 3–8 in. from the ground, minutely pubescent: lvs. linear and rigid, 2 in. or less long: fls. scattered, violet-purple, the lobes 2- or 3-cleft as far as the middle or farther into narrow spreading segments. Prairies, Ill. and Mo.—Rarely cultivated.

11. **Stellària**, Gray. Glabrous: lvs. linear, sparingly ciliate towards the base: fls. scattered, usually long-pedunceled, pale blue to whitish, the lobes cleft only at the apex into short oblong parts. Lexington, Ky., to southern Ill. G.F. 1:257.

CC. *Corolla-lobes very shallow-notched or entire.*

D. *Peduncles usually bearing few to several slender-pedicelled fls.*

12. **subulàta**, Linn. (*P. nivàlis*, Lodd.). Ground Pink. Moss Pink. Fig. 1763. Tufted or matted, the depressed stems more or less pubescent: lvs. crowded or fascicled (except on the flowering stems), narrow-linear to linear-lanceolate, very sharp and usually stiff, ciliate: fls. nearly 1 in. across, light blue, pink or white, in small clusters standing 2–6 in. above the ground, the lobes obcordate or entire. Dry banks and fields, New York W. and S. B.M. 411; 415 (as *P. setacea*). L.B.C. 8:780; 18:1731 (as *P. aristata*).—A much prized old garden plant, useful for colonizing where it is desired to cover the earth with a mat. It is much used in cemeteries. It blooms profusely in spring. The plant is very variable. *P. Nelsoni*, Hort., and *P. nivalis*, Lodd., are white-fld. forms. Var. **álba** is a common white form. There are striped forms. Var. **frondósa** is a vigorous garden form with rose-colored fls.

DD. *Peduncles chiefly axillary and mostly 1- to 3-fld., or the fls. nearly sessile.*

E. *Lvs. crowded or fascicled: plant forming a dense evergreen mat or tuft.*

13. **Douglasii**, Hook. Very low and densely tufted, pubescent or nearly glabrous: lvs. very narrow, pointed, the margins at base often ciliate: fls. small and short-stalked, purple, lilac or white, about ½ in. across, the lobes obovate and entire, the tube little exceeding the calyx. Utah and Mont., W.

EE. *Lvs. little if at all fascicled: plant only loosely tufted*

F. *Style nearly or quite equaling the corolla-tube.*

14. **adsúrgens**, Torr. Stems 3–6 in. long, diffuse and ascending, glabrous except the peduncles and calyx: lvs. ovate-lanceolate or ovate, acute, less than 1 in. long: fls. rose-colored or whitish, nearly or quite 1 in. across, the obovate lobes entire, the tube nearly twice longer than calyx. Oregon. G.F. 1:66.

FF. *Style very short.*

15. **speciósa**, Pursh. Variable in size, sometimes ascending to 3 ft., more or less glandular above: lvs. 2 in. or less long, linear to lanceolate, the uppermost broad at base: fls. rose-pink or whitish, in corymbs, the lobes obcordate, the tube little surpassing the calyx. Calif., north.

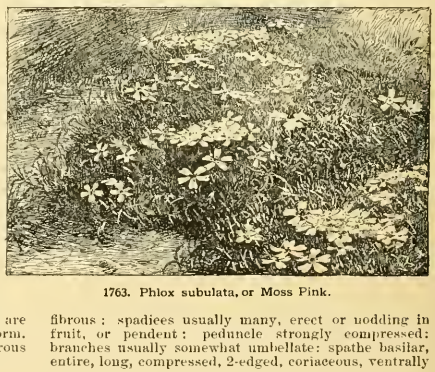
16. **nàna**, Nutt. Only a few inches high, glandular-pubescent: lvs. 2 in. or less long, linear, sometimes alternate: fls. light red or rose to white, scattered or somewhat corymbose, about 1 in. across, the lobes usually entire and roundish, the tube somewhat surpassing the calyx. Colo., New Mex., Tex. G.F. 1:413.

L. H. B.

PHŒNICOPHÒRIUM Sechellarum. See *Stevensonia grandifolia*.

PHŒNIX (Theophrastus gave this name to the Date-palm, perhaps thinking of Phœnicia, where the Greeks were supposed first to have seen it, or of the Phœnician purple, or of the fabled bird of Egypt). *Palmàceæ*. An exceedingly distinct and popular genus of palms, whose horticultural merits are discussed below.

Spineless palms, without trunks, or with stout or slender, short or long, often cespitose erect or inclined trunks, clothed above with the persistent bases of the leaves: lvs. terminal, spreading, recurved, unequally pinnate; segments somewhat fasciculate or almost equidistant, elongated-lanceolate or ensiform, acuminate, rigid, inserted by the wide base; margins entire or folded in their entire length; rachis laterally compressed, convex on the back; petiole plano-convex, usually spiny, with very short rigid pinnæ; sheaths short, fibrous: spadices usually many, erect or nodding in fruit, or pendent: peduncle strongly compressed; branches usually somewhat umbellate: spathe basilar, entire, long, compressed, 2-edged, coriaceous, ventrally



1763. Phlox subulata, or Moss Pink.

The old Date Palms (Phœnix dactylifera) at Old Town, San Diego, California

and at length dorsally divided; bracts usually obsolete: fls. yellow: fr. a berry or drupe, oblong, orange, brown or black. Species 10 to 12, perhaps more. Tropical and subtropical Asia and Africa.

JARED G. SMITH.

Phœnix in General.—The latest botanical monograph of Phœnix (by Beccari in Malesia 3:345) admits only 10 species, although there are about 60 names. Such a "lumping" of species is very unwelcome to the horticulturist, and it is probable that nearly all the synonyms cited below represent forms that are abundantly distinct for horticultural purposes.

A good horticultural appreciation of Phœnix is that by William Watson, of Kew, in G.C. III. 9:234, 298, from which liberal extracts are made below. Phœnixes differ from all other pinnate-leaved palms in having the lvs. folded upwards and lengthwise, and in the peculiar form of the seed, as seen in the Date stone. The plants are either male or female. The fruits of only one species are used for food; viz., *P. dactylifera*. (For Date culture, see *Date*.) In England only *P. rupicola* ranks among popular decorative plants. Of all palms, the cultivated species of Phœnix are the most difficult to define. Many hybrids have been raised in the gardens of the Riviera, where many species flower and fruit every year. It is almost impossible to keep these pure. Kerchove records the wonderful fecundity of a Phœnix; *P. reclinata* at Nice fertilized with pollen from *P. tenuis*, *reclinata* and *pumila* produced 20,000 seeds. The raising of Phœnixes from seed is done on a large scale on the Riviera. The seeds are sown in beds in the open and the seedlings transplanted into shallow trenches, like celery, so that the trenches may be regularly flooded during the summer drought. Watson thinks that next to the coco-palm, the Date is perhaps the most useful tree in the world.

P. Canariensis is the noblest of all Phœnixes, and one of the most majestic palms in cultivation. Its rate of growth is astonishing: a tree supposed to be only 10 years old had a trunk 4 feet high, 3 feet in diam. at the base, with about 100 lvs. forming a head 25 feet across. Another specimen of about the same size bore 8 bunches of fruit, each weighing about 50 lbs.

P. sylvestris is the Wild Date of India, where it is cultivated for its sap, which yields sugar and "toddy." The trunk attains a height of about 4 feet when 7 years old, and it is then tapped by cutting a notch in the stem at the top and catching the sap as it runs out. The tree continues to yield annually 15–18 gallons of sap for 20–25 years, or 8 lbs. of sugar per year. Fifty thousand tons of date-sugar are produced every year in Bengal alone from this and other palms.

"*P. reclinata* and *P. spinosa* are united under the former name by Beccari. Taking the dwarf, cespitose, shiny-leaved elegant plant found in Caffraria as far south as Grahamstown, and comparing it with the tall, solitary-stemmed, huge-headed, gray-green-leaved plant of the tropical regions of Africa, it is difficult to believe that they are merely forms of one species."

The following are grown at Kew in greenhouse temperature (others require stove treatment): *P. Canariensis*, *dactylifera*, *humilis* and var. *Hanceana*, *intermedia*, *reclinata* and *spinosa*.

The most interesting novelty in Phœnix during the last decade is *P. Rœbelenii*, the pygmy Phœnix. Fig. 1765. Specimens 20–30 yrs. old have stems not over 2 ft. high. Watson says: "It is by far the smallest of all the many kinds of Phœnix known, and is also exceptional in the form of its stem and in the elegance and soft texture of its bright green leaves." Watson adds that it deserves to rank with *Cocos Weddelliana* and *Geonoma gracilis* for usefulness in a small state. This palm suckers freely and in a wild state grows in clumps. Out of deference to the latest monographer, *P. Rœbelenii* is here treated as a variety of *P. humilis;* but Watson declares that it is a distinct species and that in the form and texture of its lvs. it resembles *P. rupicola* more than any other species.

W. M.

Phœnix in Florida.—No palms in the writer's Florida garden can vie in beauty, stateliness, and massive growth with some of the members of the genus Phœnix. The undersigned cultivates specimens of all the kinds offered by the trade. All the palms for this Florida garden, with a few exceptions, have been raised during

1764. Date Palm—Phœnix dactylifera.
An unusually straight-trunked specimen.

the last ten years from seed in the writer's greenhouse in Milwaukee. Most of them, although planted on high and dry sandy pineland, begin to show an elegance, stateliness and beauty entirely beyond all expectations, especially the species of Sabal and hardy Cocos, but the Phœnixes are far ahead of them all. As soon as the seedlings began to show their characteristic leaves they were sent to Florida. The first ones were set out in the fall of 1891. Of these Phœnixes several have attained a height of 10–15 ft. and a spread of lvs. 15–25 ft. in diam. The massive trunks are almost as thick as a water barrel

and the height above the ground is 4–5 ft., while at least 3 feet more are buried in the ground like a post to keep the exceedingly heavy top in position. The trunk all around and up from the ground is provided with strong lvs. 10–15 ft. long. In the lower extremity of each frond the leaflets are replaced by long formidable spines, which perhaps serve the purpose of protecting the trunk and the earth of the plant from the attacks of man and beast.

The type of the genus, the common Date-palm, *Phœnix dactylifera*, is the least ornamental of all, and its growth is disappointingly slow. The writer has seen a plant 16 years old which just now begins to form a trunk. Well-grown specimens are very fine, but they cannot be considered rivals in beauty of the four kinds which are the subjects of the four following paragraphs. *Phœnix dactylifera*, var. *excelsa*, is much more robust and rapid-growing than the typical Date.

The East Indian Wild Date, *Phœnix sylvestris*, though having the same glaucous foliage as the common species, is a rapid grower and an exceedingly beautiful and stately palm. The writer has seen specimens 12 years from the seed that had assumed a height of 25 ft., with lvs. 12–15 ft. long and a spread of the crown 25–30 ft. in diameter. It is perfectly hardy, having stood a frost of 15° above zero, and it grows equally well on high and low land, though its growth is much quicker in fairly moist soil.

The stateliest of all the palms that can be grown in the gardens of Florida is the Canary Island Date, *Phœnix Canariensis*, a species with huge trunk and immense lvs. 12–15 ft. long, with a spread of the crown averaging 30 ft. in diameter. The leaflets, which are densely set along the midrid of the frond, are flattened and are of a glossy dark green color. At an age of 8 or 10 years this species begins to form a trunk and to show its true character. The trunk is now about 3 feet in diameter and its massiveness reminds one of a water barrel. At an age of about 12–15 years this palm is a grand and noble object, a perfect picture of symmetrical beauty. There is no palm in the Florida gardens that can compare with it in stateliness and grandeur and in rapidity of growth. Its beauty is much enhanced if planted in groups or if arranged with specimens of Sabals and Cocos and the grand *Bambusa argentea*. Landscape effects can be obtained in this way that will be not only unique but at the same time enchantingly beautiful.

Perhaps of equal beauty and almost of the same stateliness and vigorous growth is a hybrid said to have been raised by the late E. H. Hart, between *P. Canariensis* and *P. sylvestris*. It has the beautiful glaucous color of the latter and the flattened leaflets as well as the sturdy growth of the former. A plant received by the writer in the fall of 1891 is now 13 ft. high, with a diam. of the trunk of 3 ft. The lower leaves, which almost rest on the ground, are over 12 ft. long, while the upper ones gracefully arch to all sides. Most of the writer's visitors from the North pronounce this the most beautiful of all his palms. It is indeed a grand and beautiful plant.

Another palm of great beauty is *P. tenuis*. It is similar to the Canary Island Date, but it has a more slender trunk and narrower and more arching leaves, which have a much lighter green color. It is of a very strong growth and soon forms fine specimens. This species belongs to the group of large-growing kinds forming a single stem. They produce no suckers at the base of the trunk to speak of. Most of the other kinds are smaller, more tender, bushy, and produce suckers freely.

According to Drude, in "Die Natürlichen Pflanzenfamilien," there are only about eleven good species of Phœnix, but there is no doubt that the limits of the various species are at present not well understood, and considerable confusion prevails among the synonyms. *P. Leonensis* and *P. spinosa* are apparently not to be separated, the latter being perhaps a synonym. The glossy green lvs. are provided on their edges with soft white threads. It is a strong-growing palm with long and slender lvs., and, as suckers are pushed up profusely, it soon forms dense clumps of great beauty which eventually attain a height of 15–18 feet. *P. reclinata*, with arching leaves, perhaps never grows higher than 10–12 ft. It is a bushy palm of a glossy dark green color. *P. Natalensis* and *P. Zanzibarensis* seem to be identical with *P. reclinata*. *P. farinifera* is a low bushy palm of great elegance from East India, and *P. rupicola* and *P. cycadifolia* are also very graceful and fine species. The latter species has the most beautiful and elegant foliage of all the species of Phœnix. *P. pumila* and *P. acaulis* are very small kinds, while *P. paludosa*, being provided along the leaves around the stem with formidable spines, forms dense and impenetrable thickets. *P. glauca* is a small-growing species with glaucous-green foliage. These are all tender palms, but they grow well on high pineland.

1765. Phœnix Rœbelenii of horticulturists, but considered by botanists to be a form of *P. humilis*. See species No. 6, on p. 1311.

All these Date-palms grow with great luxuriance in south Florida; but *P. Canariensis*, *P. sylvestris*, *P. tenuis* and the hybrid between *P. Canariensis* and *P. sylvestris* are not only the hardiest and the most beautiful of all but they form extremely elegant and stately specimens in about ten years from the time of planting. They grow most luxuriantly in low, moist, rich soil, but they also do exceedingly well on high pineland if well fertilized during the rainy season. In fact, they will thrive under an application of nitrogenous fertilizers in quantities sufficient to kill almost any other plant. The lower leaves of *P. Canariensis* often suffer from rusty spots which disfigure them badly, but the spots will soon disappear if the plants are well watered, cultivated, and fertilized.

All the members of the bushy-growing group of Date-palms are rather tender, and they have suffered severely by the heavy freezes which have visited Florida of late years. Though losing all their foliage, they will be as fine as ever the next fall if, immediately following the frost, the heart-leaf is pulled out. If left in its position it will soon rot and injure the center of the plant beyond recovery.

Deep planting is very essential with all palms, but especially with the large and massive Dates. Each plant should be set in a basin-like excavation about 6–8 ft. in diam. and 2 ft. deep in the center. If this precaution is not taken the heavy palm would very likely be blown over by strong winds. The young palm after planting works its way down until it stands about 2½–3 ft. deep in the soil; then the trunk grows upward. There it stands like a post, smoothly rounded at the bottom, emerging its long, rope-like roots in all directions but particularly downward. The writer knows of a specimen in which the ends of the roots at a depth of 15 ft. could not be found and they evidently went

down many more feet until they had reached the clay-bank or the water. There are quite a number of small feeding-roots found in dense masses all along the rope-like main-roots near the surface of the soil, but not such a network of surface-roots as we find in all the hardy species of Cocos (of the *C. australis* type), in which almost all the roots run horizontal and are mostly found near the surface, while in the species of Phœnix they run downward. The large-growing species flower profusely in the fall and winter, while the bushy species all flower during the spring months. In all the species of Phœnix the male and female flowers are borne on different individuals, and the various species flowering at the same time hybridize readily. H. NEHRLING.

Phœnix in California.—The undersigned now has growing in the ground the following species: *P. Canariensis, dactylifera, reclinata*, all large; *cycadifolia, farinifera, pumila, rupicola, tenuis*, 2–4 ft. high; *Hanceana, Jubæ, sylvestris* and *Zeylanica*, all in pots. Much confusion exists here, and few dare recognize more than the three first named. We have *P. dactylifera* as high as 100 ft. Some specimens grown from seed saved from coumercial dates have made 50 ft. of trunk in 30 years, while others of the same seeding have made but 8 ft. Either we have numerous hybrids here or else some species that no one knows. We have them in all shades of green and glaucous-green, all habits of growth, stiff and upright, pendulous and soft, narrow leaves and broad ones, slim-folded and wide-spreading, the latter like an inverted leaf of *Jubæa spectabilis*. No one here has attempted to straighten them out. The only species easily recognized everywhere and by every one is *P. Canariensis*, the gem of the genus. This is regarded by one eminent Californian nurseryman as a garden hybrid, but it always produces fertile seeds, and seedlings from it do not vary, which cannot be said of any other Phœnix here. Next in popularity comes *P. reclinata;* the others are only found in collections. *P. dactylifera* is seldom planted now, and few nurseries ever grow it. All species of Phœnix are hardy here as far as the writer knows. *P. Canariensis* is most easily removed from the ground, and the best time is Aug. and Sept., the hottest weather, as then they recuperate faster. The only other time to remove is in the early spring, before growth, and then if the weather turns cold it is risky. ERNEST BRAUNTON.

Phœnix in the North.—Although Phœnixes cannot be considered to be as decorative subjects as the Howeas and Chrysalidocarpus, they are among the hardiest of palms. For any unfavorable situation where any palm can be expected to thrive, recommend a Phœnix. Outdoors they endure the hottest sunshine without losing a particle of color, whether placed in jars, vases or beds. As house plants they are unequaled for resistance to neglect. They also bear the tying and untying and the crowding and wear and tear of public decorative work better than any other palms. The writer has a pair of specimens of *Phœnix rupicola*, which within the past six years have been packed and unpacked five hundred times; they have withstood excessive heat and cold, gas and dust, and still stand to-day in the broad sun with their arching fronds perfect. The Date-palm is not quite so graceful. *P. Leonensis* or *spinosa* is slightly stiffer than *P. rupicola*, but very handsome. Other kinds useful to the florist are *P. Canariensis, farinifera, pumila* and *tenuis*. (This paragrapb has been adapted from an article in Scott's Florists' Manual which embodies the experience of Mr. Scott and of the undersigned.) W. H. TAPLIN.

INDEX.

(Various other names will be found in horticultural literature, but the following comprise those known to the American trade.)

A. *Texture of lfts. flaccid*..... 1. **rupicola**
AA. *Texture of lfts. rigid.*
B. *Arrangement of lfts. 2-ranked.*
C. *Form of lfts. lanceolate*..... 2. **reclinata**
CC. *Form of lfts. ensiform, with filiform tips*..... 3. **paludosa**
BB. *Arrangement of lfts. 2–4 or many-ranked.*
C. *Position of lfts. equidistant.*
D. *Color of lvs. dark green*..... 4. **farinifera**
DD. *Color of lvs. light green*..... 5. **pusilla**
CC. *Position of lfts. grouped or fascicled.*
D. *Stem bulbiform: lvs. short.*
E. *Lfts. scattered, irregularly fascicled*..... 6. **humilis**
EE. *Lfts. in nearly opposite fascicles*..... 7. **acaulis**
DD. *Stem erect: lvs. long.*
E. *Lvs. very slender*..... 8. **pumila**
9. **Canariensis**
EE. *Lvs. more robust.*
F. *Foliage glabrous*.....10. **sylvestris**
FF. *Foliage glaucous*.....11. **dactylifera**

1. **rupícola**, T. Anders. (*P. Andersoni*, Hort. Calcutta). Stem 15–20 ft. x 8 in., solitary, slender, naked: lvs. 10 ft., quite glabrous; petiole compressed; segments 1½ ft., 2-ranked, not fascicled, flaccid, bright green. Sikkim, Himalaya. G.C. II. 8:45. F. 1887, p. 165. I.H. 25:318. F.R. 1:143. A.G. 13:141. A.F. 4:569.—"The numerous bright green decurved lfts. all in one plane are peculiar to this beautiful species." A form with some of the lfts. white is figured in I.H 34:3.

2. **reclinàta**, Jacq. (*P. Leonénsis*, Lodd. *P. Senegalénsis*, Van Houtte. *P. spinósa*, Schum. & Thom. *P. Zanzibarénsis*, Hort.). Stem short (3–4 ft.): lvs. 2-ranked, bright green, obliquely arcuate-recurved toward the apex; lfts. rigid, approximate, strict, 12 in. long, 1 in. wide, lanceolate, acuminate, pungent, the terminal 9 in. long, slightly bifid, the lowest spinescent. Trop. and S. Africa. F. 1871, p. 135. A.F. 4:568. A.G. 13:141; 14:410; 16:346. Gn. 39, p. 140.—*P. melanocárpa*, Naud., has black edible fruits, and was found in a garden at Nice. It is "supposed to be a variety of *P. Senegalensis*." R.H. 1894, pp. 493, 496, 497.

3. **paludósa**, Roxb. Gregarious, subarboreous: trunks 8–25 ft. high, 12–18 in. in diam., often reclining, annulate: lvs. 8–10 ft.; lfts. 1–2 ft., opposite and alternate, 2-ranked, ensiform, with filiform tips, whitish or mealy beneath; petiole 3–5 ft. long, slender, scurfy, with many long spines; sheath fibrous: fr. black-purple. Seashore, tropical Asia.

4. **farinífera**, Roxb. Shrubby: caudex at most 4 ft., thickly clothed with old leaf-sheaths: petiole with 1 or 2 pairs of spines; lfts. subopposite, 4-ranked, ensiform, rigid, pungent, dark green: fr. black. Ceylon and southern India.—"The caudex has a farinaceous pith" (Roxb.). "The foliage is so spiny that it is impossible to walk through clumps of it" (Steavenson).

5. **pusílla**, Gærtn. (*P. Zeylánica*, Hort.). Stem 10–14 ft.: lvs. rather short; lfts. very many, subequidistant, 7–10 in., spreading at right angles, 4-ranked, rigid, pungent, bright green. Ceylon.

6. **húmilis**, Royle. Stems short, tufted, bulbiform, rarely elongated: lvs. subglaucous; lfts. scattered, interruptedly fascicled. Very close to *P. acaulis*, but distinguished by the very long-peduncled, fruiting spadix. Hilly districts of India.—Var. **Hancèana**, Becc. (*P. Hancèana*, Hort.), from China, is cultivated.

Var. **Lourièrii**, Becc. (*P. Rœbelenii*, O'Brien). Fig. 1765. Lvs. 1 ft. long; lfts. 5–7 in. long, shining, dark green, soft, curved, subglaucous, often approximate, mostly falcate, not spinous at the tip. Assam to Cochin China. G.M. 38:80. A.G. 15:201. G.C. III. 6:475; 11:731. G.F. 3:273.

7. **acaùlis**, Buch. Caudex bulbiform, 8–10 in. in diam., densely clothed with sheaths and bases of the petioles: lvs. 2–6 ft.; lfts. in subopposite fascicles, many-ranked, ½–1½ ft. long, very rigid, somewhat glaucous, marginal nerve very strong; petiole 1 ft. or more, with many spines: fr. bright red to blue-black. India.

8. **pùmila**, Hort. Stem slender, graceful, 6–10 ft.: lvs. 10–16 ft. long, recurved, drooping; lfts. 8–12 in. long, 4-ranked. Gt. 20, p. 173 (description). Fla. Farm. & Fr. Gr. 1898:67.

9. **Canariénsis**, Hort. (*P. ténuis*, Versch. *P. Jùbæ*, Webb). Resembling *P. dactylifera*, but more slender and graceful in all its parts: lvs. more numerous. Canary Islands. R.H. 1888:181. G.C. III. 15:405. V. 19:51. Gng. 5:215. Gn. 57, p. 255. R.H. 1893, pp. 126, 127.—Var. **macrocárpa** is cult. in Florida.

10. **sylvéstris**, Roxb. Stem solitary, stout, 25–40 ft. high, clothed with persistent petiole bases: lvs. 10–15 ft., glabrous; petiole spiny; segments 1–2 ft., fascicled, 2–4-ranked, rigid, light green. Very close to *P. dactylifera* and perhaps the origin of that plant. India. I.H. 10:351. V. 16:101. F. 1872, p. 29. Gn. 54, p. 117. G.C. III. 10:105.—A hybrid of *P. sylvestris* and *Canariénsis* secured by E. H. Hart is highly praised by American connoisseurs.

11. **dactylífera**, Linn. (*P. cycadifòlia*. Hort.). DATE-PALM. Fig. 1764. Stem tall, erect: lvs. glaucous, arcuate-ascending; lfts. linear-lanceolate acuminate, strongly complicate, the lower 4-ranked, the upper 2-ranked, irregularly and remotely aggregate: fr. cylindrical-elliptical, 1–2 in. long. Arabia, N. Afr. R.H. 1893, p. 127.—Var. **excélsa** is cult. in Florida. See *Date*.

P. dumòsa, Hort. Saul, 1893. Of "dwarf habit." Seems unknown to botanists.—*P. glaùca*, cult. by H. Nehrling, is a name not in the texts.—*P. Natalénsis* and var. variegata are offered by Reasoner, but no description is available.—*P. Sanderiàna*. Presumably introduced within recent years by Sander & Co., St. Albans, Eng.—*P. spinulòsa*, Hort. Saul, 1893, is an obscure name.—*P. tomentòsa*, cult. by H. Nehrling, is an obscure name. JARED G. SMITH.

1766. American mistletoe—Phoradendron flavescens. (×⅓.)

PHOLIDÒTA (Greek, *scale* and *ear*; the scales of the unopened raceme are said to recall the rattle of a snake). *Orchidàceæ*. A small genus containing about 20 species, natives of India, S. China and the Malay Archipelago. Mostly of the habit of Cœlogyne, with creeping rhizomes and pseudobulbs consisting of a single internode. Fls. small, sbort-pedicelled, in slender racemes, each with a large bract; sepals and petals short, broad; labellum excavated or sac-like; column very short, winged around the top. For cultivation, use strong, light, rich potting material, broken pots, old dry cow manure, plenty of drainage. Do not allow to become very dry. Temperature, 55–65°.

imbricàta, Lindl. Pseudobulbs oblong sulcate: lvs. oblong-lanceolate, plicate, 6–12 in. long: raceme long-peduncled, 3–8 in. long: fls. small, rather crowded on the raceme, white or yellowish, with a shade of violet. Feb.–May. India. B.R. 14:1213; 21:1777. L.B.C. 20:1934.

Chinénsis, Lindl. A small creeping epiphyte. Pseudobulbs cespitose, 1–2-lvd.: lvs. oblong-undulate, acuminate, fls greenish white, in drooping racemes not more than 2–3 in. long; sepals ovate; petals linear; labellum oblong, recurved.—This plant has long been known from Chinese drawings.

WM. MATHEWS and HEINRICH HASSELBRING.

PHORADÉNDRON flavéscens, Nutt., is the Mistletoe of eastern North America. Fig. 1766. It is parasitic on deciduous trees, as far north as New Jersey and southern Indiana and extending southwards to Florida and Texas. F.R. 3:590. It makes dense bunches 1–3 ft. across, with thick oval or obovate yellowish green evergreen lvs. The forking twigs are terete, and break easily at the base. The fls. are diœcious, borne in very short spikes or catkins: berries amber-white, globular, small. The plant is collected for Christmas greens (see *Greens, Christmas*). The Old World Mistletoe is Viscum.

PHORMIUM (Greek, *phormos*, basket; referring to one use to which this fiber plant is put). *Liliàceæ*. NEW ZEALAND FLAX. The New Zealand Flax, *Phormium tenax*, is a tender herbaceous plant, 3–6 ft. high, with a tuft of 2-ranked, sword-shaped lvs. and panicles of 6-lobed fls. varying from red to orange. It is a choice plant for conservatory decoration and for subtropical bedding. It is a very formal plant, its lines being strong, stately and rather stiff,—perhaps too much so in immature specimens. The genus is easily distinguished by its fls., which are erect, numerous, panicled, the perianth with a top-shaped tube, and the somewhat incurved segments loosely connivent above. Phormium belongs to the tribe of which the day-lilies (Hemerocallis and Funkia) are representatives in the northern hemisphere and the poker plants (Kniphofia) in the southern, its nearest ally being the Australian Blandfordia with fls. of similar colors but pendulous and with stamens affixed at the middle of the tube instead of at the apex, as in Phormium. Phormiums have a short, thick rhizome and clusters of thickened fibrous roots. There are three species, all from New Zealand. The common species, *P. tenax*, is the tallest plant and generally has redder fls. than *P. Cookianum*. The rarest species, *P. Hookeri* (not in trade), differs in having lvs. which bend back until they reach the ground.

Phormiums are perhaps too slow of propagation to be ranked among the few most popular plants for subtropical bedding, but they are esteemed choice subjects by connoisseurs. They are a prominent feature of many fine establishments in California. When Phormiums are to be prop. by division G. W. Oliver recommends that they be planted outdoors in very sandy soil during May and divided during September. W. M.

For certain combinations and in places where it can have plenty of moisture *Phormium tenax* is a valuable plant, having a very distinct and unusual character all its own. The type is easier of cultivation than the variegated kinds. Much better results can be obtained by raising the typical form from seeds than by division. Seed sown in Feb. and grown on rapidly will make good plants for bedding purposes the spring of the following year. The seedlings may be either planted out or grown in pots; in the latter case give a rich compost and plenty of water after the plants have taken hold. With good treatment one may expect at the end of a year and a half a well-furnished specimen 3–3½ ft. high in a 6-in. pot. If one can afford room in a warm house, so much the better. The variegated forms require partial shade and even moisture; they do not come true from seed. J. F. COWELL.

A. *Lvs. 2–3 in. wide, split at apex.*

tènax, Linn. NEW ZEALAND FLAX. Fig. 1767. Robust: lvs. attaining 4 ft. or more, 2–3 in. wide, dark green, margin and keel bright red or brownish: scape 5–7 ft. high, much overtopping the lvs.: fls. typically

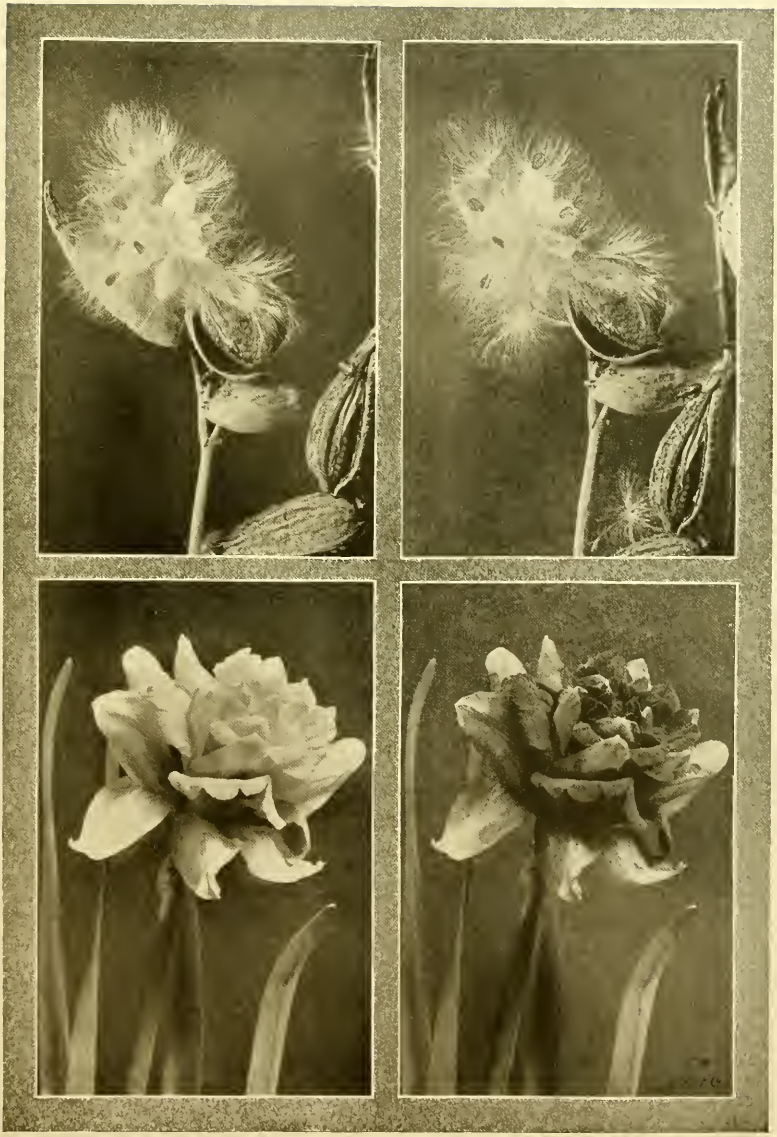
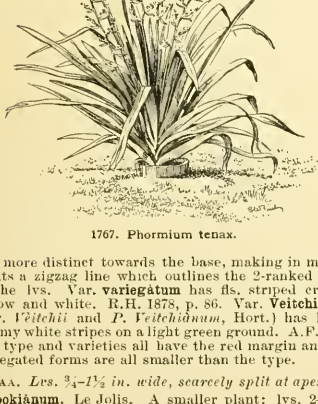


Plate XXIX. Photography

The Milkweed pod in the upper left corner was photographed on a "backed" plate to counteract halation; the view to the right shows the same subject photographed without "backing." The yellow Narcissus to the left below was photographed on an isochromatic plate (without color screen); the same flower in the same lighting, made on an ordinary plate, is shown beside it.

scarlet, but in natural forms varying almost to pure yellow; perianth 18–21 lines long. B.M. 3199. Gn. 50, p. 369. A.F. 13:748. R.H. 1848:5. V. 13:340. Gn. 26, p. 397.—Var. **atropurpùreum** has reddish purple foliage. R.H. 1877, p. 389. Var. **atropurpùreum variegàtum** is alleged to be a "veritable fountain of white, purple and rose color." Var. **nigro-pictum** (*N. purpureum nigro-limbatum*, Hort. Saul?). Lvs. deep green, with a narrow margin of blackish purple, which becomes broader



1767. Phormium tenax.

and more distinct towards the base, making in mature plants a zigzag line which outlines the 2-ranked habit of the lvs. Var. **variegàtum** has fls. striped creamy yellow and white. R.H. 1878, p. 86. Var. **Veitchiànum** (var. *Veitchii* and *P. Veitchiànum*, Hort.) has broad creamy white stripes on a light green ground. A.F. 5:39. The type and varieties all have the red margin and the variegated forms are all smaller than the type.

AA. *Lvs. ¾–1½ in. wide, scarcely split at aper.*

Cookiànum, Le Jolis. A smaller plant: lvs. 2–3 ft. long: scape 3–6 ft. high: perianth 12–15 lines long, yellower than the above. Var. **variegàtum** has yellowish white stripes. F.M. 1874:112. W. M.

PHOSPHATE. This word is often used by farmers as synonymous with commercial fertilizers. Consult *Fertility*, *Fertilizers* and *Manures*.

PHOTÍNIA (Greek, *photeinos*, shining; alluding to the shining foliage). Including *Heteromeles* and *Pourthiæa*. *Rosàceæ*, tribe *Pòmeæ*. Ornamental evergreen or deciduous shrubs, with alternate, usually serrate lvs., white fls. in sometimes very large corymbs, and very decorative red or scarlet fr. The evergreen species are tender in N. Eng., and bear only a few degrees of frost; but the deciduous *P. villosa* is hardy as far north as Massachusetts, and is very conspicuous in fall by the scarlet fall coloring of the foliage and afterwards by the numerous scarlet fruits, which retain their bright color until midwinter and are not eaten by birds. Of the evergreen species, *P. arbutifolia*, which is very similar to *P. serrulata* and also to *P. glabra*, is the best known; it is a very striking object in winter, with its large clusters of bright red fr. ripening in December and contrasting well with the glossy dark green foliage. The Photinias are not very particular as to soil, but thrive best in a rather light, sandy loam, and the deciduous ones prefer sunny positions. Prop. by seeds or by cuttings of half-ripened wood under glass and by layers; also by grafting on hawthorn or quince. About 20 species distributed from Japan and China to India and Java, 2 species in Calif. and Mex. Shrubs, rarely small trees with stipulate lvs.: fls. in corymbs or short panicles; petals 5, orbicular; stamens 10–20; styles 2, rarely 3 or 4, connate at the base: fr. a small 1- or 2-seeded pome. Closely allied to the Aria group of Sorbus and only distinguished by the top of the fr. being rounded and hollow.

A. *Lvs. deciduous: fls. in corymbs.*

villòsa, DC. (*P. variàbilis*, Hemsl. *Pourthiæa villòsa*, Decne. *Sórbus terminàlis*, Hort.). Upright shrub, to 15 ft., with slender spreading or upright branches: lvs. short-petioled, broadly obovate to oblong, cuneate, acuminate, sharply serrate, dark green and glabrous above, more or less pubescent beneath when young, 1½–3 in. long: fls. white, in 1½–2 in. broad, glabrous or villous corymbs terminal on short lateral branchlets: peduncles warty: fr. about ⅓ in. long, bright scarlet. June. Japan, China. G.F. 1:67.—A very variable species. Var. **lævis**, Rehd. (*P. lævis*, DC. *Pourthiæa argùta*, Hort.), has narrower lvs., only sparingly pubescent when young and soon glabrous, glabrous inflorescences and somewhat larger fr. G.F. 4:377.

AA. *Lvs. evergreen, glabrous: fls. in large panicles*

serrulàta, Lindl. (*P. glàbra*, var. *Chinénsis*, Maxim. *Cratægus glàbra*, Sims, not Thunb.). Shrub, to 20 ft.: lvs. with petioles about 1-in. long, oblong, usually rounded at the base, acuminate, serrulate, dark green and shining above, yellowish green beneath, 5–7 in. long: panicles to 6 in. broad: fls. ¼ in. across; stamens 20: fr. globose, ¼ in. across, red. May–July. China. B.M. 2105. L.B.C. 3:248. Stands fairly well in Washington.

glàbra, Maxim. (*Cratægus glàbra*, Thunb.). Shrub, to 8 ft.: lvs. on about ½-in. long petioles, elliptic or obovate to oblong-obovate, cuneate at the base, acuminate, serrulate, 2–4 in. long: panicles 2–4 in. across: fls. ⅓ in. across; stamens 20: fr. subglobose, red. May–July. China, Japan.

arbutifòlia, Lindl. (*Heteromèles arbutifòlia*, Roem. *Cratægus arbutifòlia*, Ait.). TOYON. TOLLON. Shrub or small tree, to 20 ft.: young branches and inflorescences usually tomentulose: lvs. oblong to obloug-lanceolate, acute at both ends, sharply serrate, shining above, 2–4 in. long: fls. white, in 2–5-in. broad panicles; stamens 10: fr. bright red, ⅓ in. across. June, July. Calif. S.S. 3:193. B.R. 6:491.—Called Christmas Berry in Calif., where the fruits are much used for Christmas decoration.

P. argùta, Wall. (Pourthiæa arguta. Decne.). Closely allied to P. villosa: lvs. longer and narrower, firmer, densely white-tomentose beneath when young: corymbs larger. Himal.—*P. elliptica*, Nichols., is Eriobotrya elliptica, Lindl., a Himalayan species not in cult. in this country.—*P. Japónica*, Nichols.= Eriobotrya Japonica. ALFRED REHDER.

PHOTOGRAPHY, HORTICULTURAL. Plate XXIX. As a means of description and of record, photography is of great importance to horticulture in all its branches. A reference to magazines and to trade catalogues of the day shows a growing use of the "half-tone" engraving process; and these engravings are merely photographs transferred to a copper plate, and by means of minute chemically-etched dots given a printing surface for the typographic press. Many other illustrations — notably many in this Cyclopedia — are adapted from or drawn directly from photographs, being then engraved by another photographic etching process on hard zinc. To a limited extent, photographs are also printed on the prepared surface of boxwood blocks, and used in lieu of a drawing as a sketch for the wood-engraver.

Every experiment station and agricultural college finds in photography an indispensable adjunct both to its records and to its descriptive work. For the botanist, photography provides both an uniquely accurate means of recording plant details, and of portraying the appearance of the growing plant in its habitat. A photographic herbarium represents the living plant more adequately than the usual dried specimens. Some of the larger nursery and seed establishments are also coming to maintain photographic equipments, in order that they may readily preserve views of the varieties which it is desired to advertise. In horticultural journalism photography is of prime importance. In advanced collegiate institutions and at the meetings of various progressive horticultural societies and institutes, the presentation of photographs by means of the stereopti-

con is found to be of enormous advantage, and the teaching or entertainment is made more efficient through this means. Therefore, all branches of horticultural activity are concerned with photography, and the progressive instructor dealing with horticultural problems in an educational institution, or handling the government's money in the experiment station work, must be able to practice photography with a fair degree of proficiency, if he is to accomplish the best results.

As Horticultural Photography differs essentially from the line of work in which the ordinary portrait photographer is engaged, some special skill and certain items of equipment are desirable for the tradesman, or experimenter, or teacher who wants to make his illustration effective. Those who deal, as does the writer, with many photographs from many "artists," come to know and abhor the thoroughly inadequate work of the ordinary professional, who is fitted both as to equipment and skill only for the picturing of the human face and form. Not once in twenty times does satisfactory and efficient horticultural photographic work come from the professional; and, therefore, the horticultural instructor or tradesman is best served by taking up photography in an independent manner.

Apparatus.—For views outdoors of trees, plants, etc., any view camera of the regulation or of the "folding" type will answer, though, as it is often desirable to obtain relatively large details of fruits or flowers or plants *in situ*, a bellows of more than the usual focal capacity or length is preferred. The modern "long-focus" cameras are suitable, and the size most used by horticulturists is that taking a plate 5 x 7 inches in dimensions. For such size a rectilinear lens with a focal length of seven or eight inches is advisable; and if one of the two lenses forming the combination is available as an objective of about double the focal length of the combination, and the camera is provided with a bellows which draws out several inches beyond the focal length of this single lens, much facility in operation is provided. Any of the modern high-class view lenses are suitable, and those of the anastigmatic type, which are not only rectilinear but also render views in a flat and correct perspective, are preferable. It need not be assumed, however, that the very highest grade lens is essential, for in the hands of a thoughtful and reasonably skilful operator, an ordinary rectilinear lens, costing, for the size mentioned, but $15 or $20, will often do satisfactory work. Whatever lens is used, it should be fitted into a quick-working shutter, as outdoor exposures, with modern rapid plates, must be made in small fractions of a second. The shutter, it may be explained to the unacquainted reader, is merely a convenient device for opening and closing the lens to the light for the interval of time desired by the photographer.

As there is frequent misconception of the work done by a lens, and as even lens-makers sometimes give faulty advice as to the proper objectives for any specified uses, it may not be amiss to suggest to the inquiring horticultural photographer an investigation on his own account. Photo-Miniature No. I, "Modern Lenses," is a brief, clear and concise statement of the principles, properties and construction of lenses, which may be consulted to advantage. The focal length of any lens, in connection with the size of the plate upon which it is to be used, determines the angle and amount of view included. The human eye is a lens of about 16 inches focal length, and to have a photograph render perspective as seen by the average eye, an objective of the same focal length is required. Thus, on a 5 x 7 plate, a lens of 8 inches focal length will include twice as much in the view, and show it in half the size as seen by the eye. This forced perspective is sometimes desirable and sometimes unpleasant. If the 8-inch lens is composed of two elements on what is known as the symmetrical plan, the rear element may usually be used alone (by screwing out the front lens), and it will have approximately double the focus of the combination. This will give about the perspective seen by the human eye, and will need to be used in connection with a bellows of at least the same length or "draw" as the focal length of the lens. Some of the high-grade lenses are now made on what is termed the "convertible" plan, each of the two elements being of a different focal length. Thus a certain lens which as a whole is of 7½ inches focus, includes one element of 12 inches focus and one element of 18 inches focus. Either of these single lenses, or the combination, may be used separately, so that from a given position three views, including proportions differing as 5, 8, and 12, may be made.

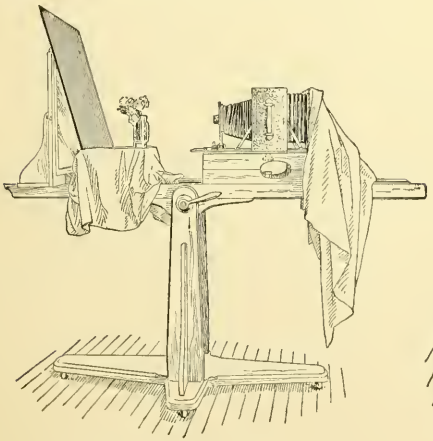
To photograph an object in natural size, the double lens is preferable. If the lens be of 8 inches focus, it will give natural size when placed equidistant between the object and the ground-glass focusing-screen of the camera, at double its focal length. Thus the bellows would need to be drawn out so as to have 16 inches between the ground glass and the lens, while the object to be photographed should be maintained in position 16 inches from the lens.

A tripod, capable of adjustment as to height, and of sufficient rigidity to sustain the camera in a moderately high wind, is easily obtained. The cheaper forms are fairly efficient, but the photographer who has much traveling to do finds it preferable to obtain one of the more expensive and carefully fitted types, which fold into a smaller compass.

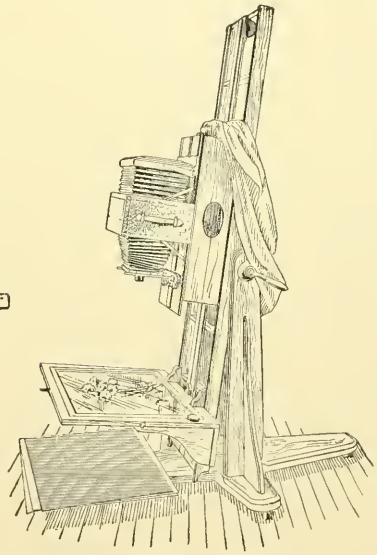
For indoor work, including the making of photographs of fruits, flowers or plants in large detail, a special form of camera-stand is very desirable. One arranged so that the camera may be maintained in an inclined or nearly vertical plane, while the object to be photographed rests on a plate-glass exposing stand in front of the lens, gives great facility and ease of operation, and does away with many difficulties of illumination. A few experiment stations possess devices of this kind. A form which has been found exceedingly satisfactory in practice is described in No. 13 of the Photo-Miniature, "Photographing Flowers and Trees," and is here reprinted by permission in Figs. 1768 and 1769, showing the camera-stand both as arranged for horizontal and for vertical work. In operation with this device, the flower, fruit or plant to be photographed is laid upon the plate-glass stand, and the camera, fastened by its tripod screw upon a movable bed, is moved backward or forward as a whole, or through its bellows, until the desired size and focus are obtained. The background may be varied to any extent desired by cardboards or cloths placed below or back of the plate-glass stand, out of focus. The camera-stand is mounted on casters, so that it may be readily moved about to secure the most favorable lighting. Objects which can best be handled on a horizontal plane may be disposed somewhat as shown in Fig. 1768. For work of this sort a north side-light is found vastly preferable to the conventional sky-light. A greater mistake in the equipment of a studio for horticultural work could not be made than to provide the sky-light deemed essential by old-fashioned professional photographers, although now happily abandoned by the more progressive workers for a "single-slant" light, which gives far better results. There should be provided in the work-room of the horticultural photographer several good reflecting surfaces, so that the side of the object opposite the main source of light may be properly illuminated.

Plates and color-values.—As practically all Horticultural Photography has to do with the tints of growing things, the well-known color inaccuracy of the ordinary dry-plate is a serious disadvantage. The ordinary plate responds most actively to the rays at the blue end of the spectrum, and is very sluggish in taking an impression from green, yellow and red, the latter color, indeed, being rendered practically the same as black. Yellow, which in actual color value is on a par with light blue, and only a few shades less intense than white, is rendered by the ordinary plate as a dark color, as all operators who have photographed yellow roses, yellow apples, yellow plums, and the like, will have observed. Fortunately, there are available photographic plates, known as isochromatic or orthochromatic plates, which, to a certain extent, correct these difficulties, and the skilful operator may, by the use of the proper plate and in some cases a suitable ray-filter, give approximately correct values to all the colors of the spectrum. For all ordinary horticultural uses, where blue and yellow are not found in the same subject, the isochromatic plate of the most rapid speed is satisfactory. It gives yellow its proper value, at the same time improving the

rendering of the green foliage and slightly increasing the truth of representation in pink, lavender, and the lighter red shades. It is very much better, then, for the photographer who has to do with horticultural work to confine himself exclusively to these isochromatic plates for all his work. If he has a subject including blue flowers, the especial activity of the blue rays, which otherwise would render the photographic impression as intense as if the object was white, can be restrained by a suitable ray-filter, which is applied in front of the lens. This ray-filter is either a glass cell filled with a one per cent solution of potassium bichromate, or a piece of plane optical glass covered with a suitably stained collodion film sealed with another optical glass and provided with a convenient mounting for slipping on the lens. With this ray-filter and the isochromatic plate before alluded to, the yellow is slightly over-valued, but the blue is given its proper relation. The beauty of outdoor photographs is vastly increased by the use of the plate and ray-filter mentioned, because a proper color value is given to the sky, and the cloud forms are preserved in all their attractiveness. If the subject be



1768. Adjustable camera-stand, horizontal position.



1769. Adjustable camera-stand, vertical position.

a heavily loaded peach tree, for instance, the accentuation of the yellow, brought about by the use of the ray-filter, will give a needed slight exaggeration of color value to the fruit, which, under treatment by an ordinary plate, will be almost indistinguishable from the mass of foliage. With the ray-filter the exposure required is practically trebled. In this Cyclopedia, advantage has been taken of isochromatic plates in photographing some of the subjects. The carnations, Plate IV, Vol. I, show a variety of shades properly rendered by the means indicated. The dahlia, Plate IX, shows the rendering of dark red shades in connection with green foliage by the isochromatic plate. The persimmon plate (XXVIII) in this volume also shows orange, yellow and red fruits as properly rendered under this isochromatic handling, and the oranges (Plate XXIII), including fruits from the light lemon-yellow Pomelo to the deep orange-red Tangierine, prove also the usefulness of the plate suggested.

A difficulty known in photographic practice as *halation* must also be counteracted if the fine detail of subjects involving much light is to be preserved. Plate XXIX shows a milkweed pod, first as photographed with a plain isochromatic plate and second as photographed with the same plate, treated so as to eliminate halation. (The two lower figures on the same plate show the value of the isochromatic plate as compared with the ordinary plate in photographing yellow tulips.) Halation is caused by the reflection of brilliantly lighted objects from the *back* of the glass plate carrying the sensitive emulsion. Light possesses enormous velocity, and there is a constant and almost inconceivably rapid play back and forth between the two surfaces of the glass plate, which is covered only on its face by the sensitive photographic emulsion. This results in a thickening of all the finer lines which should be rendered in the positive as white. It is best counteracted by "backing" the plate with a composition which will absorb all the rays of light that pass through the emulsion on the face. Any dark substance which can be brought into absolute optical contact with the posterior surface of the glass plate will answer, but the most efficient backing is provided by an alcoholic solution of soap, to which has been added a mixture of erythrosin and aurin, two red aniline pigments having high absorptive powers. This coating is easily applied, and easily removed before development; and the writer in his practice of Horticultural Photography uses isochromatic plates backed with this dyed soap-solution for all important work.

Even with the aid of the isochromatic plate and the ray-filter the photography of shades of red is difficult, because of the lack of actinic or chemical quality in the red rays of the spectrum. In practice it is found necessary to give a very much prolonged exposure to objects containing red, and then to restrain the overexposure upon development by means of a suitably compounded developing solution. Details regarding this are out of place here, but may be obtained from the works cited at the end of this sketch.

Lantern-slides.—A few words may be added concerning the production of lantern-slides, now of the greatest importance in illustrative work. A lantern-slide is a positive on glass, and therefore is made from a negative. It is made preferably on a special plate, much slower than the regular photographic dry-plate, because

coated with a silver chloride rather than a silver bromide emulsion. The slide is usually faced with a paper mask, so as to include only the desired portions of the picture, and protected by a cover glass. Negatives of any size may be used if a suitable arrangement is provided for reduction. This can readily be arranged by an adaptation of the camera-stand illustrated in Fig. 1768. A pair of light bars are added, running from the top of the plate-glass frame to a support at the other end of the stand, and a piece of heavy muslin or light canvas thrown over this serves to exclude the excess of light. A ground-glass frame is added back of the plate-glass, which latter is removed to give place to a turn-table arrangement, made to take and hold negatives of various sizes. In practice, the ground glass end is turned toward the strong light, the negative to be used is adjusted in the turn-table, and the image focused in the camera as usual. The 5 x 7 size largely used by horticulturists is in just the right proportion for the ordinary lantern plate of American practice, which is 3¼ x 4 inches. Slides may also be made by contact, if the negative to be used is of suitable size. The familiar 4 x 5, 3⅛ x 3½ and 3¼ x 4¼ hand-camera films are often so used, being placed in contact with a lantern plate in an ordinary printing frame, and given a short exposure to an artificial light. Such slides are seldom of good quality. If it is required to make lantern-slides from diagrams, engravings or any positive material, a negative must be first prepared, for making which the vertical position of the camera stand (Fig. 1769) is very convenient.

In making lantern-slides, it is important to learn the proper exposure, for errors in exposure cannot be corrected in development to any great extent. The careful worker will expose several plates upon the same subject, give all the same development, and act upon the experience thus gained.

The only work treating specifically of the photography of flowers and trees is a previously mentioned monograph in The Photo-Miniature, No. 13, published by Tennant & Ward, New York. In the same series of monographs is an excellent treatise on the production of lantern-slides (No. 9), and another on modern lenses (No. 1), previously cited. J. Horace McFarland.

PHOTOSYNTHESIS. The term Photosynthesis is derived from Greek words signifying "light" and "putting together." It is applied to that process by means of which, under ordinary circumstances, green plants build up organic or carbon-containing compounds. Carbon is the element which as a rule denotes organic substance. It is an essential constituent of the cell wall, or fiber, and of the protoplasm; likewise of starch and of sugar. Green plants manufacture practically all of the orgauic matter which may eventually furnish food for plants and animals, so that all life is ultimately dependent upon them.

Ordinary air contains only about .04 per cent of carbon dioxid; yet the green plant as a rule obtains all of its carbon from the air. Chlorophyll and light are absolutely essential in order that organic substance may be manufactured. Chlorophyll, the substance which gives the green color to leaf and branch, usually occurs in definite plasmic bodies, which are commonly oval in form. These chlorophyll bodies absorb radiant light and thus obtain energy or power to work. This energy cannot be obtained by the common plant in any other way, as by the absorption of radiant heat from a stove. The cell sap absorbs the carbon dioxid which has diffused into the leaf (see *Physiology of Plants*), and the energy obtained from light works upon the molecules of carbon dioxid (CO_2) and water (H_2O) of the cell sap in such a way that these molecules are rearranged and united. A molecule of some simple carbohydrate, perhaps formaldehyde (CH_2O), is formed; and some of these molecules are perhaps immediately condensed to sugar ($C_6H_{12}O_6$). In this process more oxygen is supplied by the water and carbon dioxid than can enter into the organic product, and this surplus oxygen is thrown off. This whole process is called photosynthesis.

An accumulation of sugar in the leaf would hinder the further manufacture of this product and much of the sugar formed is, indeed, immediately diffused to other cells. The leaf assimilates very rapidly in sunlight, and the surplus sugar formed is changed to starch, an insoluble product. This starch is usually removed from the leaf at night. In some way potassium salts seem to be necessary in the first manufacture of sugar, perhaps aiding in the condeusation changes.

It is probable that no plant containing chlorophyll in genetic connection with its protoplast remains long entirely inactive in assimilation, when illuminated. The red end of the spectrum embraces the colors which are principally concerned in the activity of the chlorophyll function. Photosynthesis is most rapid under those conditions of temperature and food supply which best stimulate growth. The process is more rapid, however, when the amount of carbon dioxid in the air is slightly increased. The presence of other coloring matters, such as brown and red, in the assimilating organs does not mean that chlorophyll is absent, and that other substances may replace it. Chlorophyll may be present but veiled by a more prominent color. It is improbable that any other coloring matter besides chlorophyll and a related substance, etiolin, is effective in carbon dioxid assimilation.

Photosynthesis may be inhibited by too intense light, by extremes of temperature, and by deleterious chemical agents. It ceases immediately in darkness, and is very feeble in weak light.

The results of photosynthetic activity may be noted in this way: An active branch of elodea or other pond weed may be kept in a vessel of water in the dark until it shows no starch with the iodine test. The branch is then placed in spring water, which contains considerable air. On placing the experiment in sunlight, bubbles of oxygen will immediately be given off. This indicates that photosynthesis is active; and after a time starch may be found in the leaves. B. M. Duggar.

PHRAGMÍTES (Greek, *growing in hedges*, which, however, does not apply to this grass). *Gramíneæ*. Species 3, one in tropical Asia, one in South America, and one, our species, cosmopolitan. Tall and stout perennial reed grasses with long running rootstocks and terminal panicles with aspect of Arundo. Spikelets 3–7-fld. Differs from Arundo chiefly in having the lowest fls. staminate, the flowering glume sharp-pointed but not bifid, and the hairs of the spikelet confined to the rachilla.

commùnis, Trin. Common Reed. Culm usually 8–12 ft. high: lvs. 2 in. wide. Marshes and along edges of ponds. The ornamental feathery drooping panicles appear in late summer or autumn. Gn. 31, p. 33.

A. S. Hitchcock.

PHRŸMA (one of the many names which Linnæus never explained). *Verbenàceæ*. A genus of one species, a hardy, perennial herb of little horticultural value. It has slender branches, coarsely toothed ovate lvs. and small purplish or rose-colored opposite fls. borne in long, slender terminal spikes. It seems to have been rarely cult. in Europe and is offered by one American dealer in native plants.

Phryma is an outlying member of the Verbena family, and is by some authors made the sole example of a family of its own. This is because its ovary is 1-celled, while the rest of the Verbenaceæ, as a rule, have a 2- or 4-celled ovary. There is some evidence for regarding it as a 2-celled verbenaceous plant in which only half of the ovary develops. This plant has the inflorescence of the Verbena tribe and the habit of Priva. Generic characters are: ovule solitary, erect, orthotropous, laterally affixed at the base: seed without albumen; cotyledons convolute; radicle superior.

Leptostàchya, Linn. Lopseed. Height 2–3 ft.: lvs. 3–5 in. long, thin, the lower long-stalked: fls. at first erect, soon spreading and the calyx in fruit closed and abruptly reflexed against the axis of the spike, the teeth long, slender and hooked at the tip. June–Aug. Common in moist and open woods, Canada to Minn., South to Fla. and Kans. B.B. 3:205.

PHRŸNIUM (from Greek word for toad, because the plant inhabits marshes). *Scitamináceæ*. About 20 herbs of the Old World tropics with creeping rootstocks and large oblong showy radical leaves. The genus is closely

allied to Calathea and Maranta and is often confused with them. The Marantas are New World plants with 1 seed-bearing locule in the fruit, whereas Calathea and Phrynium usually have 3 seed-bearing locules. In Calathea, the flower-cluster is terminal on a leafy stem or rarely on a leafless scape arising directly from the rhizome; in Phrynium, the cluster is lateral from the sheathing petiole. In Calathea the corolla-tube is usually slender; in Phrynium it is usually short. Phryniums are grown the same as Calatheas and Marantas (which see). It is probable that there are no true Phryniums in the Amer. trade. **P. variegàtum**, N. E. Brown, is *Maranta arundinacea*, var. *variegata*. It is a stove plant of dwarf habit with ovate-lanceolate acuminate green leaf-blades which are marked with cream-white or white stripes and bands. I.H. 33:606. F.R. 3:469. Gt. 46, p. 581. J.H. III. 28:27. It is a worthy plant, now coming to be popular. For *Phrynium eximium*, see *Calathea eximea*. L. H. B.

PHYGÈLIUS (*flight* and *sun*, because it was said to love the shade). *Scrophulariàceæ*. Two species of south African shrubs, one of which is in the trade. The flowers are long and tubular, not unlike those of a Pentstemon in looks, scarlet, with exserted stamens in 2 pairs, and a long, filiform declined style: fr. a many-seeded capsule. The lvs. are opposite and petiolate, crenate-dentate.

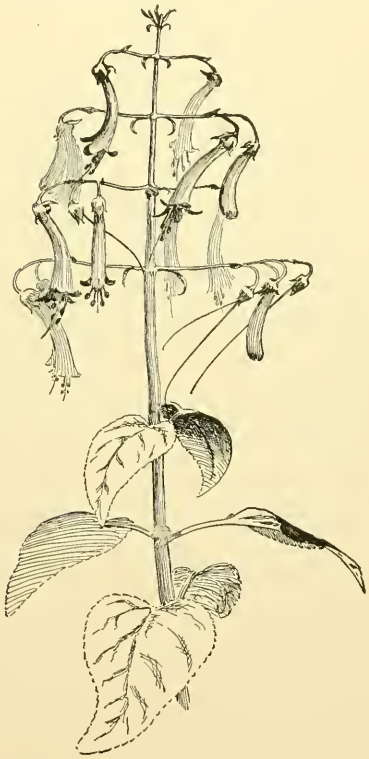
Capènsis, Meyer. CAPE FUCHSIA. Fig. 1770. Erect, becoming woody at the base, glabrous, the stem with 4 angles or narrow wings: lvs. ovate, rounded at the base, firm and veiny, bluntly small-toothed: fls. slender, 2 in. long, somewhat curved, 2-lipped, purple-scarlet, 1–4 together on the ends of straight-spreading peduncles, drooping. Cape of Good Hope. R.H. 1857, p. 599; 1886, p. 473. B.M. 4881. F.S. 11:1111.—A fine subshrub blooming in summer and hardy in protected places as far north as Philadelphia. In the North it is lately becoming known as a greenhouse plant. It is excellent for planting out, enduring heat and dry weather as well as geraniums, or even better. It is propagated by seeds and also by cuttings. The cuttings may be taken from the late fall shoots of outdoor plants. Phygelius is a showy plant, deserving to be better known. L. H. B.

PHYLLÁGATHIS (Greek. *divine leaf*). *Melastomàceæ*. Four species of herbs from the Malay Archipelago belonging to a family noted for its numerous stove foliage plants. The lvs. of *P. rotundifolia* are praised for their colors, both above and below, their venation, their plaited character, and their strong shadows and reflected lights. The lvs. are glossy green above, tinted along the nerves with metallic blue and purple; beneath they are a rich coppery red, with the prominent nerves of a brighter color. About 10 strong nerves sweep with graceful curves from base to apex.

These plants have short, thick stems: lvs. opposite or the terminal solitary, large-petioled, roundish, cordate at the base, entire or denticulate: fls. crowded into a short-peduncled head, rosy, about ½ in. across; petals 6, rarely 3; stamens 8, rarely 6: ovary 4-celled, rarely 3-celled; capsule top-shaped, 4-valved. The nearest ally in cult. is Sonerila, which ordinarily has 3 stamens, rarely 6.

"*Phyllagathis rotundifolia* belongs to the same family as the better known *Sphærogyne latifolia* and *Cyanophyllum spectabile*. It somewhat resembles the former in general appearance. A few plants of it were given a test outside during the summer at Washington, D. C., in 1899, in a position partly shaded from the sun. They behaved well, and in such a situation, where the surface of the soil is covered with some low-growing plant, as Hydrocotyle or Lysimachia, to keep the sun from the roots, it may become a valuable feature for outdoor decoration. But for indoors, it may be used as a substitute for the more gaudy-leaved Sphærogyne, as it succeeds in an atmosphere in which the majority of greenhouse plants can be grown. Propagation for small plants is by the leaf, the petiole of which is inserted in sand, the blade lying flat on the surface, and the ribs severed in several places. From the cut parts nearest the petiole, numerous small growths are made; these may be potted when an inch or so high. For making specimen plants quickly, old subjects which have been encouraged to branch may be cut up, and the pieces inserted in pots in bottom heat. They send out roots very quickly."—Oliver's "Plant Culture."

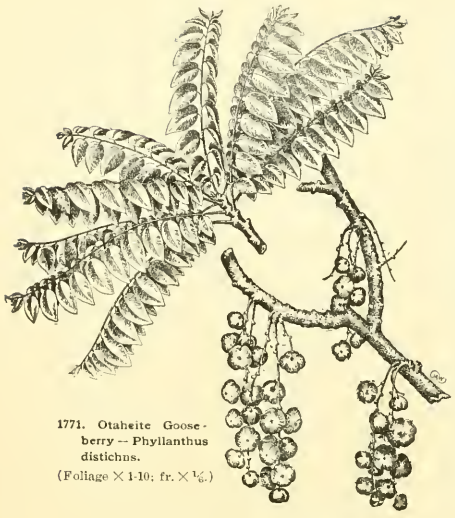
rotundifolia, Blume. Stem rooting at intervals, 4-sided, dark purple: lvs. 6 in. or more by 4½ in., roundish ovate, abruptly acuminate, denticulate: floral parts in 3's or 4's. Sumatra. B.M. 5282. W. M.



1770. Phygelius Capensis (× ⅓).

PHYLLÁNTHUS (Greek, *phyllon*, leaf, *anthos*, flower; because the flowers are apparently borne on leaves). *Euphorbiàceæ*. Herbs or shrubs, without milky juice: lvs. small, alternate, entire, usually in 2 lateral rows on the small branchlets which then appear like pinnate lvs.: fls. axillary, apetalous, monœcious or diœcious, the staminate in small clusters without a rudimentary pistil, pistillate solitary; sepals 4–6, separate from the disk, imbricated; stamens 2–6 or more, usually 3: capsule with 3 to many 2-seeded cells, often fleshy; embryo large: cotyledons broad.

More than 400 species, mostly in tropical regions. A few only are cult., mostly for their graceful foliage. Monographed by Mueller in DC. Prod. 15, 11:274, where he divided the genus into 44 sections, some of which, as Emblica, Cicca and Xylophylla, have been considered by others as separate genera.



1771. Otaheite Gooseberry — Phyllanthus distichus.
(Foliage × 1-10; fr. × ½.)

A. *Foliage of large, broadly ovate-elliptical variegated lvs., not pronouncedly distichous.*

nivòsus, Smith. SNOW-BUSH. Shrub of loose habit, with dark wiry somewhat zigzag branches: lvs. 1–2 in. long, obtuse, white and green mottled: fl. small, greenish, discoid, hanging by long pedicels from the leaf axils. S. Sea Islands. F.M. 1874:120. I.H. 25:332.—Var. **ròseo-pictus,** Hort. Lvs. mottled with pink and red as well as white and green. Gn. 10, p. 261. F. 1878, p. 13. —Used in the house and for bedding out in summer.

AA. *Foliage of narrowly elliptical or ovate, distinctly distichous green lvs.*

Émblica, Linn. EMBLIC MYROBOLAN. A much-branched shrub or small tree: foliage branches with many linear-elliptical, obtuse lvs., which are close together and ½–¾ in. long: fls. small, short-pedicelled in the axils of the lower lvs.: capsule baccate, ¾–1 in. in diam. E. Indian region. L.B.C. 6:548.—Fruit used raw or preserved: foliage handsome.

distichus, Muell. (*Cicca dísticha,* Linn.). OTAHEITE GOOSEBERRY. Fig. 1771. Shrub, with ovate acute lfts. 1–2 in. long: fls. on separate branches below the foliage: fr. fleshy, edible. India and Madagascar.—W. Harris, of Hope Gardens, Jamaica, W. I., writes that the Otaheite gooseberry is an elegant shrub or small tree often cultivated in gardens in the lowlands of Jamaica and the West Indies. The fruit is very acid and astringent; the root is an active purgative, and the seed is also cathartic. The fruit is occasionally pickled, or made into preserves. Plants are raised from seeds.

pûlcher, Wall. (*P. pallidifòlius,* Müll. *P. glaucéscens,* Hort. ? *Réidia glaucéscens,* Miq.). A small shrub: lvs. much like the last, but ovate-elliptical, ½–1¼ in. long, glaucous below: fl. small, red and yellow, the pistillate near the end of the foliage branches, on long pedicels, the staminate below; sepals laciniate: capsule small, globose, puberulent. Java. B.M. 5437. G.F. 4:161.

AAA. *Foliage of flattened stems bearing scale-like lvs. and fls. on the margin.*

speciòsus, Jacq. (*P. arbúscula,* Gmel.). A small shrub: floriferous branches, lanceolate, striate, crenate, 2–3 in. long. Jamaica. B.M. 1021 (as *Xylophylla latifolia*).

P. angustifòlius, Sw. B.M. 2652. Near speciosus. Fls. small and yellowish on the margins of the branches. Known as Xylophylla montana. Native to Jamaica.—*P. atropurpùreus,* Hort.=var. of P. nivosus, with dark purple lvs.—*P. Chantrièri,* André. R.H. 1883, p. 557. Sepals fringed. Cochin China.—*P. salvieefòlius,* HBK. R.H. 1883, p. 176. Leaflets truncate. Fls. small, somewhat globular. S. Amer.

J. B. S. NORTON.

PHYLLIRÈA. See *Phillyrea.*

PHÝLLITIS (Greek, *a leaf;* from the simple foliage). *Polypodiàceæ.* A genus of ferns popularly known as the Hart's-tongue fern, with simple lvs. and elongated sori at right angles to the midrib; indusium appearing double from the coalescence of two sori, one produced on the upper side of a veinlet and the other on the lower side of the veinlet next above.

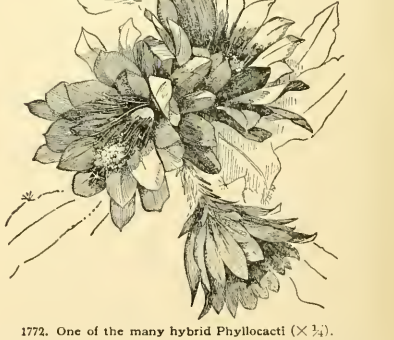
Scolopéndrium, Newman (*Scolopéndrium vulgàre,* Sm.). HART'S-TONGUE. Lvs. 10–15 in. long, heart-shaped at base, 1–2 in. wide, growing in tufted clusters. Widely distributed in Europe, where there are many curious varieties in cultivation; and local on corniferous limestone in central New York; also in Canada and Tennessee.

L. M. UNDERWOOD.

PHYLLOCÁCTUS (Latin, *phyllum,* a leaf; from the flattened leaf-like stem). *Cactàceæ.* Branches flat, two-edged, crenate on the margins, the crenatures bearing the flowers, and bristles rather than spines. The fruit is often angled, usually scaly, but without spines or wool. About a dozen species are recognized by botanists, but few are known in the wild state, and most of them have so profusely hybridized with each other and with species of Cereus, especially *C. speciosus,* and even with Echinopsis, that many of the forms in cultivation are wholly doubtful. In strict priority the genus should be called by the older name Epiphyllum, under which nearly all the species have received names.

In their native haunts Phyllocacti are often epiphytic; consequently in cultivation they do not require as much sunlight as most other genera of Cactaceæ, and water can be more freely supplied to them. See also *Cacti.*

There are hundreds of Latin names in the catalogues which seem to represent species, but they are horticultural varieties or hybrids. One of the hybrid forms is shown in Fig. 1772.



1772. One of the many hybrid Phyllocacti (× ¼).

A. *Tube of fl. 4–8 in. long: flowers white or yellowish white within, often rosy on the tube and outer sepals, 4–10 in. in expansion.*

B. *Style white.*

grándis, Lem. Very large, sometimes 20 ft. long: stems slender, round or 2-edged, with flat, leaf-like,

lanceolate, often very long and large, undulate branches: fls., including the tube, nearly 1 ft. long, 5–6 in. in expansion, opening, according to Schumann, in the daytime. Honduras; also said to be found in Cuba.

crenâtus, Lem. In cult. commonly not much more than 3 ft. high, freely branching from the lower part of the stem: branches thick, with a strong midrib, but thinning to the edges, which are rather deeply crenate: fls. greenish yellow outside, 6–10 in. long, and about as much in expansion, day-blooming. Honduras.

angŭliger, Lem. About 3 ft. high, many-stemmed: basal stems cylindrical, hard and woody, the large leafy branches deeply cut in the margins, like the teeth of a very coarse saw: fls. 5–8 in. long, the tube very slender. South Mexico. B.M. 5100.

BB. *Style red.*

stenopétalus, Salm-Dyck. (*P. latifrons,* Zucc. ?). Branches very long and large, crenate or somewhat serrate, acute or acuminate: midrib and usually side ribs evident; areolæ with rather large scales and dark bristles: fl. 8–10 in. long, spreading and in full bloom bent backwards; petals narrow. Perhaps from Mexico.—Much advertised as the Queen Cactus.

Hoökeri, Salm-Dyck. Branches long but narrow, crenate-serrate, in age dark or bluish green, often reddish on the margins; midrib strong and side ribs evident: fls. 6–8 in. long, yellowish white within, reflexed in full bloom. Brazil and Guiana.

strictus, Lem. Erect, branching, reaching a height of 10 ft., with long cylindrical branches and shorter, leaf-like secondary branches: crenatures or teeth rather deep, unequal on the opposite sides; bristles wanting: tube of the fl. very long and slender, outer sepals brownish, inner pure white; the flower opens late in the evening and closes before dawn; in full bloom the sepals are very strongly recurved. Said to come from the island of Cuba.—Often found in collections under the name of *P. latifrons.*

AA. *Tube of fl. very short: fls. red. Day bloomers.*

Ackermanni, Salm-Dyck. Fig. 1773. Stems numerous, sometimes reaching 3 ft., somewhat recurved: branches usually less than a foot long, with evident middle and side ribs; areolæ on the lower and younger shoots bearing short bristles: fls. scarlet-red outside, carmine-red within, the throat greenish yellow, tube very short, the limb wide-spreading, 4–6 in. in diam. B.R. 16:1331.—Not known in the wild state.

phyllanthoides, Link. Branches at length hanging, cylindrical at base, lanceolate above: serratures obtuse; middle and side ribs evident; bristles few; fl.-tube 2 in. long or less, with spreading scales, the limb somewhat longer, often striate. South Mexico.

bifórmis, Lab. Soon pendulous, the branches cylindrical: short branches leaf-like, the lower egg-shaped, the upper more lengthened: fls. small, purple-red, less than 2 in. in expansion: ovary without scales or angles. Honduras. B.M. 6156. V. 2:159.

In addition to the species described above, the following are recognized by Schumann: *P. acuminatus, caulorrhizus, Gærtneri, phyllanthus, Russelianus* and *Thomasianus.* Of these, *P. Gærtneri* and *Russelianus* are usually included in Epiphyllum; *P. caulorrhizus* is perhaps an unusual state of some other species; *P. Thomasianus* described from a garden plant is almost certainly a hybrid. *Epiphyllum Guedneyri* is by some referred to Phyllocactus.

KATHARINE BRANDEGEE.

PHYLLÓSTACHYS is treated under Bamboo. *P. heterocycla,* now in the trade, is in the supplementary list on page 130. Since the Bamboo article was printed, *P. Marliacea* has been introd. to American trade. It is a rare bamboo, hardy in England, of which Mitford says: "It presents such a marked resemblance to *Phyllostachys Quilioi* that I do not think any expert could tell them apart without examining the wrinkled base of the stem, to which *Phyllostachys Marliacea* owes its Japanese name, Shibo-chikee, 'the wrinkled bamboo,' and which makes it so useful for canes and umbrella sticks."

1773. Phyllocactus Ackermanni (×⅓).

PHYLLOTÆNIUM. See *Xanthosoma.*

PHYMATÒDES (Greek, *a close network*). *Polypodiàceæ.* A genus of ferns allied to Polypodium and sometimes united with that genus, but differing in the fine copious irregular areolæ formed by the anastomosing veinlets and the free included veinlets spreading in every direction. For culture, see *Fern.*

A. *Lvs. simple.*

Swártzii, Underw. (*Polypòdium Swártzii,* Baker). Lvs. 2–4 in. long, ¼–1 in. wide, narrowed gradually toward both ends: sori in a single row each side of the midrib. Florida Keys and tropical America.

musæfòlium, Blume. Lvs. 1–3 ft. long, 3–4 in. wide, with an acute point, the lower part winged to the base; main veins very distinct, with numerous small sori almost covering the whole surface. East Indies.—Known also as *Drymaria* and *Polypodium musæfolium.*

AA. *Lvs. deeply pinnatifid.*

nigréscens, Blume (*Polypódium nigréscens,* Blume). Lvs. 2–3 ft. long, 1 ft. or more broad, cut nearly to the rachis into numerous entire lobes 1–2 in. wide; surfaces naked, dark green; sori in a single row nearer the midrib than the edge, sunk in deep cavities which are prominent on the upper side. India to Polynesia.

glaúcum, Kunze (*Polypódium glaúcum,* Kunze). Lvs. 12–18 in. long, 6–8 in. broad, cut down to a winged rachis into entire lobes ¼ in. or more wide, both sides naked, glaucous; veinlets indistinct: sori forming a single row close to the midrib. Philippine Islands.—*Phlebódium Máyii,* Hort., A.G. 19:455. F.E. 10:600, is a horticultural form. G.C. III. 23:328, fig. 21.

L. M. Underwood.

PHÝSALIS (Greek for *bladder,* because the thin calyx enlarges and incloses the fr.). *Solanàceæ.* Husk Tomato. Ground Cherry. Herbs of warm or temperate countries, the larger number American. They are variable and therefore confusing to the systematist.

1774. Physalis ixocarpa in its cultivated form (fruits × ⅓).

The species number anywhere from 30 to 100 or more, depending on the author. The genus is allied to Nicandra, and more remotely to Capsicum, Lycopersicum and others. The flowers are usually not showy, and are much like those of Solanum in structure; corolla rotate or short bell-shaped, plicate in the bud, 5-lobed or 5-angled, usually blue or yellowish, borne solitary in the leaf axils; stamens not united or connivent. The calyx greatly enlarges in fruit, becoming a bladder inclosing the 2-loculed mostly yellow or greenish berry. Lvs. alternate, mostly angled and usually distinctly stalked. Most of the species are of little consequence horticulturally, although *P. Alkekengi* and *P. Francheti* are much prized for the glowing red very large calyxes, and *P. pubescens* and *P. Peruviana* are grown for their edible fruits. Several of the species are known for their fruits where they grow in a wild state. In most parts of the U. S. and Canada one or more species grow about gardens, in fields, and in waste places. These species are popularly known as Ground Cherry. The fruits are usually made into preserves, although they are sometimes eaten raw. The common cultivated species are annuals, or are usually treated as such in this country. They require no extra care. Usually the seeds are sown indoors in the North, in order to secure as much of the crop as possible before frost. Most of the cult. species are long-season plants, and therefore need to be forwarded in the spring. The high colors of *P. Alkekengi* and *P. Francheti* do not develop until the fruit is ripe. Give a warm, sunny exposure. The plants do not withstand frost. Let the plants stand 1–2 ft. apart in the row.

A. *Plants with large red calyxes in fruit.*

Alkekéngi, Linn. Alkekengi. Strawberry Tomato. Winter Cherry. Bladder Cherry. Diffuse grower, usually with zigzag mostly simple angled pubescent stems: lvs. ovate, with broad base, angular, the petiole widening at the top: fls. whitish, the anthers yellow: fr. red (sometimes eaten), the ripe large calyx blood-red and very showy. Seems to be native from southeastern Europe to Japan, but now adventive or naturalized in many parts of the world. Gn. 41, p. 577; 49, p. 233; 57, pp. 28, 432.—The Strawberry Tomato is an old garden plant, grown for its highly colored bladders. The plant grows 12–18 in. tall. Of easiest culture. In the North, plants are usually started indoors. It is a perennial, the roots withstanding much frost if protected, but it is usually grown as an annual. Not hardy in the northern states.

Franchéti, Mast. (*P. Alkekéngi,* var. *Franchéti,* Hort.). Chinese Lantern Plant. Differs from *P. Alkekengi* chiefly in its greater size, making a plant 2 ft. tall and bearing calyxes 2 in. in diam. In his original description of the species, Masters (G.C. III. 16, p. 434) makes the following characters: "It differs from *P. Alkekengi* in being an unbranched annual, not a perennial, with a fibrous root, with erect branches, not creeping at the base, glabrous instead of setose, in its much larger size, in the leaf-stalks being considerably shorter in proportion to the blade." Japan. G.C. III. 16:441. Gn. 48, p. 435; 49:1059; 57, p. 28; 58, p. 196. G.M. 37:626. J.H. III. 29:343. R.H. 1897:376 and p. 35. R.B. 22:61; 23, p. 91. Gt. 45, p. 636; 46, p. 193. A.G. 18:81. F.R. 1:426.—One of the most profusely advertised novelties of recent years. It is a most striking and showy plant. It was brought

1775. Physalis pubescens (fruits × ⅓).

to England from Japan by James H. Veitch, and first described with a name by Masters in 1894. In 1879, however, it had been described by Franchet, of the Jardin des Plantes, Paris, as a form of *P. Alkekengi,* but without name. The fruits are very brilliant orange-red in the fall. The berry is said to be edible. Some writers describe the plant as perennial.

AA. *Plant with green or yellow or at most only red-veined calyxes. Mostly grown for the edible berry.*

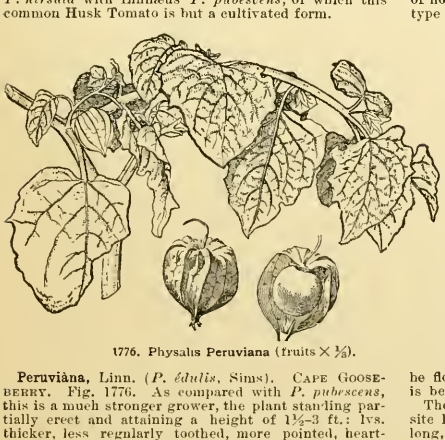
B. *Stems glabrous or very nearly so.*

ixocárpa, Brot. Fig. 1774. Erect, 3 or 4 ft. tall, bearing smooth branches and lvs., the latter thin, ovate or lance-ovate and variously toothed or notched: fls. large and open (¾ in. or more across), the border bright yellow and the throat bearing 5 black-brown spots; anthers purplish: husk purple-veined and entirely filled by the large round, purplish sticky berry, and is sometimes torn open by it. Mexico, and introduced northwards to the northern states.—The form in cult., described here, is probably *P. capsicifolia,* Dun., now regarded by some as a form of the cosmopolitan *P. angulata.* The writer prefers, however, to refer the plant to *P. ixocarpa* as outlined in Britton & Brown, although there is doubt as to the identity of the cult. plant with this species. Although the cult. plant is sometimes sold as *P. edulis* (erroneously), the fruits are usually too mawkish to be

eaten from the hand (at least as grown in the N.). It is a very vigorous and productive plant and is of some consequence as an ornamental, but it is too weedy to be of much value. The fr. is larger than in the native *P. angulata*. The plant figured by Carrière as *P. violacea* (R.H. 1882:216) is the one here described. In Mexico, the fruits are said to be used in the making of chilli sauce and as a dressing for meats, usually under the name of "tomatoes." The Mexican forms are confused.

BB. *Stems pubescent or hairy.*

pubéscens, Linn. STRAWBERRY TOMATO of vegetable gardens. DWARF CAPE GOOSEBERRY. HUSK TOMATO. GROUND CHERRY. Fig. 1775. Low, trailing flat on the ground, or sometimes ascending to the height of a foot: lvs. rather thin and nearly smooth, more or less regularly and prominently notched with blunt teeth: fls. small (¾ in. or less long), bell-shaped, the limb or border erect and whitish yellow, the throat marked with 5 large brown spots; anthers yellow: husk smooth or nearly so, thin and paper-like, prominently 5-angled and somewhat larger than the small, yellow, sweetish and not glutinous fruit. N. Y. to the tropics.—The plant is very prolific, and the fruits are considerably earlier than in the other species. When ripe the fruits fall, and if the season is ordinarily dry they will often keep in good condition upon the ground for 3 or 4 weeks. The fruits will keep nearly all winter if put away in the husks in a dry chamber. They are sweet and pleasant, with a little acid, and they are considerably used for preserves, and sometimes for sauce. The plant is worthy a place in every home garden. It is grown more or less by small gardeners near the large cities, and the fruits are often seen in the winter markets. The chief objection to the plant is its prostrate habit of growth, which demands a large amount of ground for its cultivation. In good soil it will spread 4 feet in all directions if not headed in. The plants are set in rows 3 or 4 feet apart and 2 or 3 feet apart in the row. This Physalis has been long in cultivation. It was figured by Dillenius in 1774, in his account of the plants growing in Dr. Sherard's garden at Eltham, England. In 1781–6 it was figured by Jacquin, and by him called *Physalis Barbadensis*, from the island of Barbadoes, whence it was supposed to have come into cultivation. In 1807, Martyn also described it under the name of Barbadoes Winter Cherry, or *Physalis Barbadensis*, and says that it is a native of Barbadoes. None of these authors say anything about its culinary uses. Dunal, in 1852, described it as var. *Barbadensis* of *Physalis hirsuta*, but later botanists unite Dunal's *P. hirsuta* with Linnæus' *P. pubescens*, of which this common Husk Tomato is but a cultivated form.



1776. Physalis **Peruviana** (fruits × ⅓).

Peruviàna, Linn. (*P. édulis*, Sims). CAPE GOOSEBERRY. Fig. 1776. As compared with *P. pubescens*, this is a much stronger grower, the plant standing partially erect and attaining a height of 1½–3 ft.: lvs. thicker, less regularly toothed, more pointed, heart-shaped at the base, and very pubescent or fuzzy: fls. larger (½ or ⅝ in. long), open-bell-shaped, the limb or border widely spreading and light yellow, the interior or throat blotched and veined with 5 purple spots, the authers blue-purple: husk thicker and larger than in the last, somewhat hairy, and has a much longer point. Tropics. B.M. 1068.—This species is too late for the northern states. The berry is yellow, not glutinous, and much like that of *P. pubescens* in appearance, but it seems to be less sweet than of that species. This plant has been cultivated for two centuries, probably. It was described and figured by Morison in 1715 in England. In 1725 Feuillée gave a description of its cultivation in Peru, saying that it was then cultivated with care and was greatly esteemed as a preserve. The particular form of the species cultivated in our gardens is that which was described and figured by Sims in 1807 as *Physalis edulis*, the "edible Physalis." Sims' account says that "this plant is a native of Peru and Chili, but is cultivated at the Cape of Good Hope, in some parts of the East Indies, and more especially at the English settlement of New South Wales, at which latter place it is known by the name of the Cape Gooseberry, and is the chief fruit the colonists at present possess; is eaten raw, or made into pies, puddings or preserves." The plant is rarely sold by American seedsmen.

P. lobàta offered by dealers is not known to the writer. It is advertised as one of the Ground or Winter Cherries, with violet fruit. It is probably not P. lobata, Torr. Perhaps a form of the cultivated P. ixocarpa.—*P. Philadélphica*, Lam., a native species, is said by Britton & Brown to have been "formerly cultivated for its fruit." L. H. B.

PHYSIÁNTHUS (Greek, *bladder flower;* referring to the base of the corolla-tube). *Asclepiadàceæ*. This genus was long ago referred to Araujia, but the plants are still known to our trade under the names of Physianthus and Schubertia. Araujia is a genus of about 13 species of shrubby twiners from the American tropics, closely resembling in superficial characters the popular Stephanotis, having the same large white waxy fragrant 5-lobed fls. *A. graveolens*, in particular, has been suggested as a rival to the Stephanotis, especially as it requires less winter heat, but its foliage when bruised emits a strong and offensive odor, especially with young plants. *A. sericofera* has considerably smaller fls. and is one of several plants advertised as "Cruel Plants," because they entrap insects, though they may not digest their dead bodies as in the case of Nepenthes. These Cruel Plants are mostly members of the milkweed and dogbane families, which have essentially the same kind of floral structure—a highly complicated and specialized type adapted to cross-fertilization by insects. In Fig. 149 of this work, an insect is seen struggling in the clutch of a common milkweed, with a pair of pollen-masses hung over one of his hind legs like saddle-bags. *Araujia sericofera* catches moths in a slightly different fashion. See G. C. III. 20:523. For other "Cruel Plants," see *Cynanchum* and *Vincetoxicum*.

When well grown, Araujias bloom freely throughout Sept. and Oct. They seem to have no special soil requirements and may be flowered outdoors from seed sown indoors in early spring, or they may be kept permanently in a cool greenhouse and grown from cuttings. It is seldom that we see *A. graveolens* grown well in greenhouses, the plants being usually sickly and infested with mealy bug. As a summer vine in the open it makes vigorous growth, and after midsummer it usually blooms profusely. The fls. are larger than those of Stephanotis. Cuttings make the best flowering vines. These may be taken from the ripe wood before cool weather. Seeds are freely produced, and germinate well soon after being sown. Araujias are considered hardy in the most favored parts of England, and are grown outdoors in Calif. *A. graveolens* can be flowered in pots, but the border of the greenhouse is better.

There are about 13 species of Araujia, all with opposite lvs. and whitish or rosy fls.: corolla-tube short or long, inflated at the base; lobes 5, very wide or narrow, overlapping toward the right in the bud; crown with

5 scales attached to the middle of the tube or lower, flat and erect or convex and appressed to the staminal tube: seeds long, bearded. Schubertia and Physianthus should perhaps be considered as subgenera, the former containing the hairy plants with somewhat funnel-shaped fls.; the latter nearly glabrous plants with somewhat salver-shaped fls.

A. *Fls. 2-2½ in. across, umbellate.*

Araûjia gravèolens, Masters (*Physianthus gravèolens,* Hort. *P. auricomus,* R. Grah. *Schubèrtia gravèolens,* Lindl. *S. grandiflòra,* Mart.). Densely covered with harsh, spreading yellow hairs: lvs. 3-4½ x 2-2¾ in., obovate, acuminate, greatly narrowed and cordate at the base, hairy on both sides: fls. funnel-shaped, i. e., swelled at the throat. S. Brazil. B.M. 3891. B.R. 32:21. G.F. 3:369. G.C. III. 4:271. Gn. 32:607. A.G. 13:695.

AA. *Fls. 1 in. across, cymose.*

Araûjia sericófera, Brot. (*A. álbens,* G. Don. *A. sericífera,* Ind. Kew. *Araûjia sericófera,* Mottet. *Physianthus álbens,* Mart.). Nearly glabrous: lvs. 3 x 1¾ in., oblong-acuminate, wide and square at the base, minutely pubescent below: fls. salver-shaped, i. e., not swelled at the throat, pale rose in the bud and only faintly odorous. S. Brazil. B.M. 3201. B.R. 21: 1759. G.C. III. 2:653; 20:523. R.H. 1857, p. 89; 1883, p. 488. Gn. 24, p. 409; 34, p. 397. Mn. 6, p. 206.—The plant as above described is the *Physianthus albens* or *Araujia albens* of the trade.

G. W. Oliver and W. M.

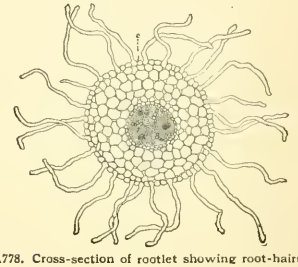
PHYSIC NUT, FRENCH. *Jatropha Curcas.*

PHYSIOLOGY OF PLANTS. *What Plant Physiology Means.*—The very fact of cultivating plants presupposes some knowledge of how the plant lives, i. e., of plant physiology. The pristine cultivator sought to imitate nature, and by a system of selection and in favoring by cultivation the few plants which seemed best suited to his wants, he really improved and developed what he demanded for use. Thus with but little knowledge of how the plant lives, improvement in definite directions has gone forward from the earliest times. Nevertheless, the limitations in improvement have been regulated rather by limitations in man's knowledge of plant-life than by any lack of capacity for development in the plant itself. Every new discovery in plant physiology must eventually be of value to the horticulturist in one way or another, and the fundamentals of physiology are of prime importance.

1777.
Root system of squash plantlet showing adherence of soil particles.

A study of plant-life in field and garden alone would hardly have given foundation for plant physiology as a science. With a knowledge of the intimate structure of the plant the experimental method must be applied both in the field and in the laboratory. Neither actions nor processes can be intimately known unless the separate activities are in some way isolated and each for itself investigated by a study of cause and effect. From the germination of the seed, and the interesting changes which this involves, through all of the intricate living processes of breathing, taking in of food, digestion and assimilation of food material, and the formation of new plant substance, we have the plant living, the plant in action. Similarly, as a sensitive organism, it is to be studied as acted upon by all of the external conditions about it, and as responsive to every change of environment. In the broader sense of the term, physiology is a study of this living, sensitive, adaptable, reproductive plant.

Every living process and every change produced by season or other condition has its charm and interest if the underlying principles are understood. A knowledge



1778. Cross-section of rootlet showing root-hairs.

of these broadens the sympathies for the general observer of plants and gives the reflective cultivator a truer appreciation of the buoyant living organism with which he deals.

The Functions of Organs Differ.—Root, stem, leaf and flower are definite organs or parts of the common cultivated plant, and as distinct organs each of these has definite physiological functions, more or less peculiar to itself. The root of the soil, bog, water, or epiphytic plant has in each case peculiarities and modifications of structure, permitting it to do best the slightly differing functions which each is called upon to perform. In the same way there are variations in the requirements of leaf, stem and other parts commensurate with the conditions of growth and the functions of the parts in their relations to external conditions.

Desert vegetation consists generally of very curiously modified plants. There are, in general, wonderfully thickened and reduced green stems. Many of these plants may store up large quantities of food in their stems, and in some a large supply of water may be stored to tide the plant over long periods of drought. Except in the novel interest afforded, these modifications are more or less meaningless unless it is remembered that here physiological conditions have been seriously modified, and the plants have met their needs in the most serious way. As compared with other vegetation, structure has here been violently subordinated to function.

Oxygen Supply and Respiration.—Even the plant of ordinary culture is not such a dependent organism as its lack of general locomotion would imply. It lives, moves and works every day. In every living process work is accomplished. There is work in maintaining the rigidity of its structure, in absorbing food material, in supporting and accomplishing the various complex internal processes of assimilation, growth, and development. The forcing of its roots through the soil and rock, and the resistance to the stress of winds and other agencies are examples of the energy daily expended in maintaining itself. In order to accomplish this work, oxygen is necessary, as with the animal, the energy being secured from the breaking down of organic compounds. Ordinarily, the leaf and stem are bathed in the atmosphere, and so the superficial presence of oxygen is always assured. By the leaves and green stems oxygen is absorbed mainly through pores (called stomates, or stomata) in the epidermis. The stem may also secure a further supply through certain corky cushions known as lenticels, found abundantly in sumac, walnut, elder, etc. Roots also require a constant supply of oxygen, and terrestrial or soil roots suffer greatly if deprived of it for short periods of time. A field of Indian corn flooded with water will soon present a very unhealthy appearance, on account of the fact that water forces the air out of the soil. Cultivation is in part a means of aërating the roots. Many greenhouse diffi-

culties are directly traceable to over-watering, or "cold feet," the effect of too much water being partially to prevent aëration. Water plants have adapted themselves to getting oxygen in other ways, and many bog plants send to the surface special roots for aërating purposes.

No plant can live without oxygen. In some way or other oxygen must be secured. The more active a plant is, whether in growth or in movement, the more oxygen will it require. Even dry seeds must respire slightly, and in some kinds respiration may be so rapid that after a single season death may ensue. This use of oxygen, whether by the germinating seed or by the growing or assimilating part, is accompanied by the giving off of carbon dioxid, or fonl gas. This whole process is respiration; and in its ultimate effects it is similar to respiration in animals.

The Role of Water in the Plant.—Even quicker to manifest itself than the action of suffocation by lack of oxygen is the injury which most plants may suffer from an insufficiency of water. The rigidity of an herbaceous or succulent plant is due largely to its water content; and without a substantial degree of this rigidity, growth would cease and life soon become extinct. The plant pulled up by its roots or cut down, wilts almost immediately. The wilting of plants, then, is due to a lack or loss of water supply.

The way in which the ordinary plant may constantly obtain a quantity of water from the soil is worthy of full discussion. On pulling from the soil a growing plantlet of squash, we find a tap-root and a number of small rootlets. To the latter cling, perhaps, small particles of the soil, as in Fig. 1777. If, however, seeds are germinated between pieces of moist paper or cloth so that there will be no disturbance of the delicate growing parts, further structures will be evident. From a quarter of an inch or so behind the root-tip, and extending backward for a considerable distance, the rootlets are clothed with numerous delicate hairs (shown in Figs. 1778 and 1788). These are the root-hairs, and it was to such as these that the soil clung in Fig. 1777. They are simple, long, tube-like cells consisting of a cell wall with living protoplasm and cell sap. The inner protoplasmic lining of this cell wall permits water and salts in solution to pass inward by the interesting process of osmosis.

The root-hairs are temporary structures which never grow into rootlets, but which die away as the roots become old or woody. While living they perform the important function of absorbing from the soil nearly all of the water needed by the plant. Being numerous and extremely delicate, they come into the closest touch with the surface film of water adhering to the little particles of soil, and from such film water they more readily satisfy their needs than from free soil water. They can extract water until the soil contains only a very small per cent, or until it is dust-dry.

The root-hairs absorb water freely, and during active growth it is forced upward into root and stem so vigorously that a pressure (root pressure) of considerable extent may be manifest. If the plant be severed and a tube applied to the stump, this pressure manifests itself by lifting a column of the liquid absorbed, and often to a considerable height. In any herbaceous plant it may be tested, as in Fig. 1779. In the grape vine 36 ft. of water may be maintained. The bleeding of plants is an evidence of root pressure.

Water is actually absorbed in much greater quantity than is required merely as a constituent of the plant body. In fact, to form one ounce of plant substance it is estimated that 15–25 pounds of water must pass through the plant. This surplus water passes off through the leaves and other succulent parts, principally through the stomata previously mentioned. This process is one of evaporation from living membranes, and it is called transpiration. That transpiration is not merely an evaporation process may be roughly shown by an experiment with two similar leafy branches freshly severed. One of these is dipped in hot water to kill the protoplasm, then the two are left to dry out. Transpiration from the living twig will be less rapid than evaporation from the dead one. The demonstration of transpiration is an easy matter. A leafy branch of any plant may be cut off and the end inserted through a bored cork into a bottle of water. Over the whole may be placed a larger jar or bell-glass, and in a short time a mist will collect on the inside walls of the latter. Transpiration is facilitated by dry air, wind, high temperatures, movement of the plant, etc. If on a hot day or in dry weather transpiration is greater than the amount of water absorbed by the roots, the plant wilts. A very slight shower will refresh a wilted plant, but not because the leaves have absorbed water. The plant recovers because the air is saturated, and transpiration is thereby so much lessened that the roots can catch up in furnishing the necessary supply.

Fully a quart of water is daily transpired from a forming cabbage head, and the number of tons of water daily given off per acre by forest or even meadow-land may reach an astonishing figure. The amount of water transpired by a small potted plant may be readily weighed. Place the pot in a glass jar as seen in Fig. 1780, tying over the top and snugly around the plant some soft rubber cloth. Water the plant through the glass tube and then weigh. After standing 6 or 12 hours in a dry atmosphere the weight will be considerably reduced, due to the loss by transpiration.

1779. To test root pressure.

The path of the ascending water current or sap current is through particular vessels of the young woody parts. In trees it ascends in the youngest wood rings, not between bark and wood. In herbaceous netted-veined (dicotyledonous) plants the path is in the ring of woody tissue or bundles between the bark and pith. In the Indian corn (monocotyledonous) it is in the thread-like groups of fibers (fibrovascular bundles) scattered rather irregularly throughout the pith. That the current is always through these

1780. Experiment to determine the amount of water transpired.

woody bundles in the above plants may be demonstrated by placing branches of the plants in a tumbler containing some eosin solution. In a few hours the bundles will be colored for a considerable extent. The current will rise much faster if the branch to be used is cut under water. This prevents the access of air and the partial stoppage of the conducting channels. For the same reason flowers wilt less rapidly when the stems are cut under water.

The total amount of water in plants varies from a very small percentage in dry seeds to about 50 per cent in

green wood, and often as much as 95 per cent in the pumpkin.

The Food Supply of Salts from the Soil.—Besides securing from the soil its water supply, the plant must secure in the same way all of its ash constituents, and usually all of its nitrogen, as soluble salts. The salts furnishing food are such well-known food ingredients, or constituents of fertilizers, as potash compounds,

1781. Sweet pea grown in soil containing the tubercle-forming organism.

1782. A similar plant in a soil freed from the tubercle bacteria.

phosphates, nitrates, etc. The various mineral elements generally necessary for the plant are potassium, phosphorus, sulfur, calcium, magnesium, and iron in small quantities. These, as well as other inessential elements, are the constituents that remain in the form of ash when the plant is burned in air. That each one of these elements, as well as nitrogen, is necessary for the full development of the higher plant has been repeatedly demonstrated. For this demonstration seedlings are supported and grown in jars containing culture solutions. One or more of the above elements may be left out in certain cases to be compared with one in which all are present, and it will then be found that growth and development will soon be arrested where even one necessary element is entirely absent.

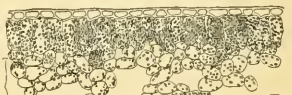
Nitrogen Sometimes Furnished by the Air.—Plants ordinarily get their nitrogen from the soil as nitrate of soda, saltpeter, or other soluble salts. This is the rule, and although the air contains about 75 per cent by weight of the free gas nitrogen, it is in this form entirely inert to most plants. Leguminous plants (Leguminosæ) form a great exception to this rule. On the roots of such plants are found swellings or tubercles, as in Fig. 1781, caused by the growth of parasitic bacteria. By the aid of these bacteria, the plant is able to appropriate the free nitrogen of the atmosphere and to thrive in a soil almost free of nitrates. This has been demonstrated repeatedly with plants in sand or water cultures. Utilizing the free nitrogen of the air, leguminous crops, whether used as green manure or not, restore the land by returning to it more nitrogen than is taken away. They necessarily enter into any thorough system of rotation upon weak lands, and represent an important economic factor in horticulture, particularly in orchard culture.

The Association of Roots with Fungi.—Other plants are also aided by an association of the root with certain filamentous fungi. In connection with the roots of the oak, beech and other woody as well as herbaceous plants, this association of root and fungus (termed mycorhiza) is of much aid in the absorption of solutions from the soil. In such cases it is thought that the

fullest development of the plant is dependent upon the presence of the fungus.

The Formation of Organic Substance.—Next to the elements of water (hydrogen and oxygen) carbon forms the bulk of the plant substance. It is a constituent of all starchy, sugary or nitrogenous (organic) products, and of all woody fiber. It is, in fact, the element whose presence indicates organic substances. When plants are burned in an atmosphere more or less devoid of oxygen, the bulk of the remaining charcoal is pure carbon, for the ash present would be so small in volume that it might be neglected. The ordinary green plant obtains this carbon only from the carbon dioxid of the atmosphere. Carbon dioxid forms only .04 to .05 per cent by weight of the atmosphere, and in order to enter into the composition of the plant, it must first diffuse itself into the tissues of the leaves and other green parts. The leaf is so constructed that the diffusion of carbon dioxid readily takes place. Numerous stomata lead from the epidermal surfaces into the air spaces, which penetrate all parts of the leaf, as in Fig. 1783. By means of this system of communication, diffusion results, and the carbon dioxid is brought into contact with a large absorbing surface of living cells. Together with favorable growth conditions, however, the utilization of carbon dioxid depends upon the leaf-green (chlorophyll) and sunlight. The green chlorophyll absorbs a considerable part of the rays of sunlight, and by means of the energy thus provided carbon dioxid (CO_2) is forced to unite with a portion of the absorbed water (H_2O). The union of these substances is accomplished by an obscure process, but in such a way that eventually carbon and the elements of water (hydrogen and oxygen) are united in the form of a carbohydrate. This substance is first readily demonstrable as starch, —of the composition $C_6H_{10}O_5$. In this process of union, or synthesis, there is an excess of oxygen furnished, and it is this oxygen which is thrown off by the leaves. This process of uniting carbon dioxid and water under the influence of chlorophyll and sunlight in the living tissues is known as photosynthesis—a building up of higher substances by sunlight. The process is also called carbon dioxid assimilation. Photosynthesis and respiration are, in a way, reverse processes; in the former carbon dioxid is absorbed in sunlight and oxygen given off; in the latter, as previously noted, oxygen is constantly absorbed and carbon dioxid given off. However, the ordinary plant, as a whole, respires but feebly, while it assimilates carbon very rapidly in sunlight. The result is that by night a small amount of carbon dioxid is given off and by day a large amount of oxygen. See *Photosynthesis*.

The starch made in sunlight and stored in the cells of the leaves is in the form of insoluble granules, like commercial starch. In order to be utilized by the protoplasm in growth, or in forming further plant substance, it must first be transformed, or digested. This is constantly taking place in the leaves by means of an enzyme called diastase. The diastase converts the starch to a soluble substance, a form of sugar, and this sugar may then be used immediately in building up more complex organic compounds used by the protoplasm, or the sugar may be transported to some storage organ



1783. A cross-section showing the cell structure of a typical leaf.

of the plant, such as root (dahlia), stem (potato), or thickened leaf, and there be reconverted to starch or changed to some insoluble or more complex product. This translocation of the starch formed in the leaves by day may be so thoroughly effected during a single night that none will remain as starch by the next day.

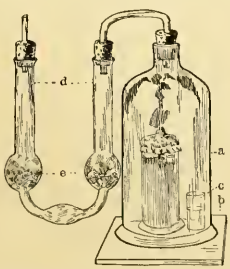
An unfailing test for starch is a blue or blue-black reaction on the addition of a weak solution of iodine. A bit of starch paste, or the cut surface of a potato or other starchy area, will quickly show this reaction. In green leaves starch may be tested by first dissolving out the chlorophyll in alcohol and then staining the leaf with iodine. In the same way one examines a leaf variegated with white. The green or colored parts of the leaf alone will show starch, the white areas showing no blue or purplish coloration, demonstrating that they have formed no starch.

It requires a glass apparatus, such as is shown in Fig. 1784, to demonstrate that a land plant cannot form starch in an atmosphere free of carbon dioxid. Over a small potted plant (or better, the plant may be transplanted to a glass jar protected at the top by rubber cloth) is placed the vessel *a*, cemented to the glass plate, *b*. A solution of caustic potash in *c* absorbs the carbon dioxid in the vessel, and all air admitted must pass through the U-tube *d*, which contains at *e* pumice stone soaked with caustic potash. This plant exposed to direct sushine for a few days will show no starch formation on testing its leaves. In a short time it will also become unhealthy and cease to grow.

Not only does chlorophyll act in conjunction with sunlight for the manufacture of starch; but, in general, sunlight is absolutely necessary in order that chlorophyll may be normally developed. Seeds germinated in a darkened vessel or potato sprouts which have pushed into growth in a darkened cellar will remain yellow or white. Moreover, the plants will grow long and slender, and death will result when the plantlet can no longer draw upon the parent part for starchy matters. The total dry weight of such plants will not be greater than the dry weight of the original seed or tuber. In this connection it might be stated that fern spores require some light in order that germination may occur, while the germination of ordinary flowering plants is slightly retarded in the presence of light.

The sugar into which starch is converted for translocation is abundant in the leaves; and it is also transferred to all living parts of the plant, along with other organic products, besides the various salts in solution which have come up to the leaves from the soil. Under the influence of the active protoplasm of the leaf-cells or of other tissues, more complex compounds necessary in growth may be formed. All parts of the ordinary plant are dependent upon the roots for a supply of the mineral salts and nitrogen; but, on the other hand, they are entirely dependent upon the leaves for the first organic substance, and for much prepared food.

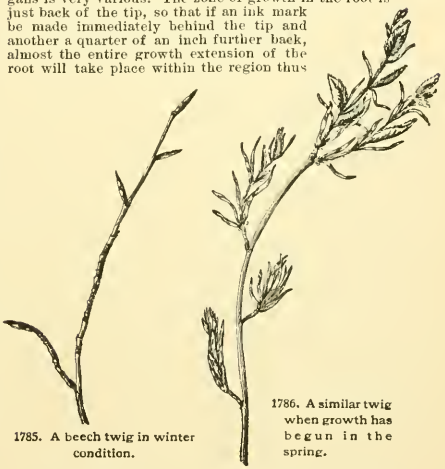
Growth, and the Differentiation of Structure.— Plant growth is apparent to the unaided eye as change in form and size of organs and tissues. The real evi-



1784. An apparatus for demonstrating that plants cannot form starch in the absence of carbon dioxid.

dence of growth is in the multiplication of the tissue cells, or of constructive changes in the form and bulk of these cells. Growth may be so rapid that it may be readily measured, or it may proceed so slowly or by such obscure internal modifications that very little external indication of the complex processes will be manifest. Even under such adverse conditions as that of deciduous trees in winter, some slight growth may be taking place, and it is not well to dissociate from the idea of a living plant all growth phenomena. Nevertheless seeds and other air-dried plant parts may live without growth for considerable periods.

The growth in size and length of different plant organs is very various. The zone of growth in the root is just back of the tip, so that if an ink mark be made immediately behind the tip and another a quarter of an inch further back, almost the entire growth extension of the root will take place within the region thus



1785. A beech twig in winter condition.

1786. A similar twig when growth has begun in the spring.

marked. There is no growth in the very tip, because it is hard and protected by a stout cap to aid in forcing its way through the soil and around hard obstacles. The region of greatest cell division is nearer the tip than the region of greatest elongation. On the other hand, the young stems of annual plants and the rapid elongation of the young shoot may for a time show growth throughout the entire extent. The winter condition of a beech twig is shown in Fig. 1785, and the long, delicate, overlapping scales of the buds are very evident. Each bud is an incipient branch, as is readily seen in the spring when the buds elongate; the delicate scales separate farther and farther from one another, each bearing a little leaf in its axil, and marking a now distinct joint or node in the new branch. Various stages of this general elongation are evident from Fig. 1786. Finally as the branch lengthens throughout its entire extent, the scales drop, the leaves expand, the older nodes cease to elongate, and the wave of elongation follows a few nodes behind the terminal bud.

In the common woody plants growth in diameter is accomplished by means of a distinct but thin layer of tissue functioning as the zone of cell division, or cambium. The cambium is located just between the wood and bark. In fact, it divides a complete ring of fibro-vascular bundles into an inner or woody portion (xylem) and an outer or bast and sieve-tube portion (phloem). Each year it gives rise on the inner side to a layer of wood and on the outer side to a layer of bark, thus each year covering up and pushing to the center, as it were, the old wood, and pushing outward the old bark as a protective covering. By this process the inner wood retains its former dimensions, but the bark must constantly expand to cover the increasing diameter of the tree, and so it breaks into rifts and ridges of various forms, or else peels off periodically. The differentiation of the tissues in different parts denotes different physiological functions. Thus the woody part of the young rings conducts the water and other soil foods, and through the woody bundles of the leaf-stalk, veins, and veinlets it is distributed throughout the plant body. The bark or phloem portion of the bundles is largely

concerned in the conduction of the digested or leaf-formed foods to other parts.

Seed Production.—So far as we know, the ultimate function of a plant in nature is to produce seeds or to reproduce its kind. It matters not how far the horticulturist may have diverted this natural function in particular instances, in general the sum of the physiological activities is directed to seed-production. Much energy is directed to the development of form and color in the flower, also of fragrance and odor, and there are deep-seated physiological processes connected with pollen and ovule production, with pollination, fertilization (see p. 579), and the subsequent development of the seed.

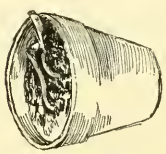
Seeds are, as a rule, richer in nitrogenous matter than other parts of the plant. Likewise, in phosphorus and magnesium salts there is a marked increase in the seed. Of these last-named substances, there is a migration, as it were, from the older parts to the region of seed formation, and finally to the seed. On the other hand, the salts of lime gradually increase in quantity in the older tissues, particularly in the old assimilatory tissues.

The Living Protoplasm the Seat of Vital Action.—Physiological activities cannot be thoroughly studied by the use of the plant as a whole or by the use of the organs as particular parts of a complex whole. The final seat of all the plant activities resides in the living protoplasm of the cells composing the plant. Except as serving purely mechanical purposes, the old heart wood and bark of trees are inactive, and they contain no living substance. They are made merely of the hardened walls of cells which once constituted living parts. The actual living parts, such as the leaves, buds, flowers, fruits, and young wood, are composed of living cells. The most essential part of a living cell is the protoplasm, a semi-fluid, viscid substance which constitutes the living material in all organisms. A definite layer of the protoplasm surrounds the inner surface of the cell wall, and protoplasmic strands radiate throughout the cell, in which is also differentiated a denser and absolutely essential part termed the nucleus. In addition the cell contains an abundance of cell sap, or water, holding in solution certain food substances. The cell wall is a mechanical support, and as a physiological agent it is quite dependent upon the protoplasm. In conjunction with the wall layer of protoplasm, the cell sap absorbs water osmotically from weaker solutions outside, and by the same process solutions are passed from cell to cell and diffused throughout the growing parts. When transpiration is proceeding it is some of this water of the cell sap which is given off through the leaves into the air. As a result of this loss of water the protoplasm contracts away from the cell wall and the rigidity (turgor) of the cell is lost. Thus the cells and the tissues lose strength, and the plant becomes flaccid and wilted.

It is by means of the chlorophyll, but it is not the chlorophyll alone which has to do with the formation of starch from carbon dioxid. The chlorophyll is imbedded in the living substance, forming definite chlorophyll bodies; and it is only when associated with living matter that it can perform its functions.

The Plant is Affected by External Conditions: It is Irritable.—When a seed is put to germinate, the first requisite is that it shall imbibe water and swell. Oxygen is at hand, and if the necessary temperature prevails the protoplasm is awakened to activity, and new growth is incited. The protoplasm increases in bulk in existing cells, and then cell division begins. At first the embryo draws upon the seed for its food supply, and is able to establish itself in the soil. A differentiation into tissues and organs having different functions has already occurred. Moreover, as soon as growth begins, the influences of external agencies assert themselves. The first shoot does not wander about in the soil, but, directly against the force of gravity (negatively attracted), it directs itself upward. In an exactly contrary manner, the first root attracted by the stimulus of gravity (positively attracted) directs itself downward. Only the overthrow or overbalancing of gravity by some superior stimulus can prevent this reaction. If a pot containing a seedling be placed upon its side, the stem will actually curve when some growth has already occurred, bending itself directly upward, as shown in Fig. 1787. The root will form a curve in its growth, and again grow downward. The response of growing organs to the stimulus of gravity is called geotropism. Geotropism acts upon the active growing part and by means of the living protoplasm.

The relation of the plant to light, or the light stimulus, is one of the most pronounced phenomena in nature. In a dark chamber young shoots will direct themselves or grow directly toward light admitted through a small slit. Note how the seedling bends toward the light in Fig. 1788. If exposed, the roots would direct themselves in a contrary manner. Even the mature leaves of all plants will turn or lean toward the source of light. This may be well observed outside when the sun is low, and at any time of day with a window garden. An interesting case of the response to light is to be found in the wild lettuce (*Lactuca Scariola*), which is known as a compass plant. In sunlight this plant holds its leaves in a vertical plane, one row of leaves pointing north and the other south. This provision may be to avoid the full rays of the midday sun, and yet to secure the best advantage of the less intense forenoon and afternoon sunshine. The response of plant organs to the stimulus of light is known as heliotropism.



1787. Negative geotropism of the young stem.

1788. Young seedling showing root-hairs, and also stem bending towards the light.

In the same way plant organs will be stimulated to grow towards or away from air (aerotropism), a certain degree of moisture (hydrotropism), a definite temperature (thermotropism), nutrient substances or other chemical agents (chemotropism) mechanical irritation (thigmotropism) and other stimuli. In all of these ways the plant is active and irritable. In all cases it is the active protoplasm which is concerned in determining the nature of the response.

Temperature has a marked effect upon all living processes and it deserves particular mention. It may limit either by too great heat or too intense cold each of the particular vital activities. There are three critical temperatures for growth, a maximum or higher temperature, a minimum or lower temperature beyond which on either side no growth takes place, and the optimum, or that intermediate grade which brings to the best development all of the faculties of the plant. Sometimes the optimum as reckoned by the amount of growth would not correspond to the optimum for flower or seed production, a fact well recognized in greenhouse culture. The growth optimum may also be a temperature at which the plant is more readily attacked by parasitic diseases. Particular varieties or species vary greatly as to their susceptibility to disease at different temperatures. Often it is of more value to know the temperature at which the general sanitary conditions for a plant are an optimum, rather than to know the optimum for growth alone. The absorption of water by the root-hairs, the manufacture of starch by the leaves, transpiration, and other processes are to a large extent dependent upon the temperatnre. Hot, dry winds of the summer-time often cause serious injury to trees, owing to the rapid transpiration from the leaves. In dry seasons this is very likely to occur with the Norway maple. Fig. 1789 represents an injury of this kind. As a rule,

the leaves on that side of the tree from which the wind comes are much more injured than others.

The annual fall of the leaf in deciduous trees is usually a matter of temperature, although drought and other conditions may also cause periodic defoliation. It would cost much labor to protect the large green surfaces during the winter and it is economy to part with a portion of the structure. The cool days of autumn

1789. A cluster of leaves of the Norway maple injured by hot winds.

chill the root-hairs and irritate the assimilatory organs. The former cease to perform their normal absorptive functions, and from the leaf are gradually withdrawn the substances which are readily made soluble. The cell walls and the less useful parts are left, and by the formation of a distinct corky layer across the leaf-stalk, where it is attached to the main stem, the plant cuts off its assimilatory organs by a natural process, so that no wound or injury except the well-healed leaf-scar shall mark its fall. In this process the chlorophyll is oxidized and changes from green to some other color, as yellow or red; and often it is by this means that the beautiful autumn colors are developed. These colors also serve very likely as a protection to shield twigs and trunks from the hot autumn sunshine. Likewise, the twigs themselves may be provided with color for the same purpose.

The old leaves are dropped in the autumn, but already a new set of modified leaves in the form of bud-scales have been formed, in turn to be defoliated the next spring, after serving a term of winter protection. Deciduous trees then shed their summer leaves when growth ceases and their winter leaves when growth is awakened.

Plants such as the squash and potato may be killed by a degree of cold less than the freezing point. It is because the protoplasm of the cells is stimulated to give up its water into the spaces between the cells, and then not being held by the protoplasm, this water is readily evaporated and the plant dies from being dried out. In the same way a plant may wilt and eventually be much injured if cold water is applied to its roots. In general, freezing consists in the drying out of the protoplasm and the formation of ice crystals between the cells. The plant may recover if the protoplasm can gradually reabsorb this water; it will die if the water is not reabsorbed.

The effect of temperature upon orders and species of plants is very evident in the differing character of the vegetation in different life zones. Temperature is not alone the cause of the difference, but it is the principal factor. In the tropics succulent plants predominate, and gigantic leaf surfaces abound as accommodation to the great moisture content of air and soil. In the temperate regions there is a degree of heat encouraging perfection of size in woody development coupled with a considerable luxuriance of foliage, as well as a large development of herbaceous plants. In arctic regions the more succulent green growth is entirely suppressed, in general smaller woody forms abound, and even the texture of leaves and fruit is expressive of hardiness.

Plants along the seacoast differ from those farther inland, the salt spray having a very injurious effect upon those which have not become resistant to it. Around the edges of ponds and lakes there is a struggle for position, and as a rule the differing capacities of the plants to thrive in differing depths of water, or degrees of moisture, cause them to be arranged in definite colonies or zones.

The sum of the responses to these and other stimuli determine the form and character of the plant, and determine whether it shall very closely resemble its ancestors, or whether it shall have characteristics varying slightly from them. From the same parent a dandelion of the mountain-side will differ somewhat from the dandelion of the lowland meadow. External agents, under which category cultivation is an important factor with domesticated plants, act not only slightly to change individuals, but in time to change varieties and species. Working from one generation to another, in conjunction with natural or artificial selection, external agencies develop new forms and habits as the plant adapts itself more perfectly to these conditions. In this way plants vary as individuals, and in time as races or species. These variations are but slight from one generation to another, but it is safe to say that there are few cultivated plants to-day which resemble exactly their ancestors of the Linnæan times.

Literature.—Among works upon plant physiology may be mentioned Sorauer's "A Treatise on the Physiology of Plants," translated by Weiss (Longmans, Green & Co.); Detmer's "Practical Plant Physiology," translated by Moor (The Macmillan Company); and Pfeffer's "Physiology of Plants," translated by Ewart (Clarendon Press). The first mentioned is intended for the use of gardeners, and the others are technical treatises. Such books as "Living Plants and Their Properties," by Arthur & MacDougal; "The Survival of the Unlike," by L. H. Bailey; "A Theory of Horticulture," by Lindley; "Plant Relations," by J. M. Coulter; and other similar works may be consulted with much profit.

B. M. Duggar.

PHYSOCÁRPUS (Greek, *physa*, bladder, and *karpos*, fruit; alluding to the inflated capsules). Syn., *Opulaster*. *Rosaceæ*, tribe *Spiræeæ*. Ninebark. Hardy ornamental deciduous shrubs, of spreading or erect habit, with stipulate, alternate, petiolate and mostly 3-lobed lvs. and with umbel-like heads of whitish fls. appearing late in spring, terminal on short branchlets along the stems and followed by clusters of small pods, inflated in some species and often assuming a bright red color late in summer. They are well adapted for shrubberies

1790. Ninebark—Physocarpus opulifolius (× ¼).

and grow in almost any soil. Prop. easily by either hardwood or greenwood cuttings, also by seeds. Five species in N. America and Amurland, allied to Spiræa and formerly mostly referred to this genus, but distin-

guished by the stipulate lvs. and the often inflated pods dehiscent along both sutures and containing one or few shining yellowish seeds, the bark peeling off in thin strips. Also sometimes united with Neillia.

opulifòlius, Maxim. (*Spirǽa opulifòlia,* Linn. *Opulàster opulifòlius,* Kuntze). NINEBARK. Fig. 1790. Shrub, to 10 ft. high, with wide-spreading and recurving branches: lvs. roundish ovate, usually cordate at the base, 3-lobed, with the lobes crenately dentate, 1–3 in. long, usually glabrous beneath: corymbs 1–2 in. broad, many-fld.: pedicels and calyx glabrous or pubescent: pods 3–5, inflated, much longer than calyx-lobes. June. Quebec to Ga., west to Manitoba and Kansas. B.B. 2:195.—Var. **lùtea,** Kirchn. (var. **sùrea,** Hort.). Lvs. bright yellow at first, changing to golden bronzy yellow. Var. **nàna,** Kirchn. Dwarf form with smaller, less lobed, dark green lvs.

Amurénsis, Maxim. (*Spirǽa Amurénsis,* Maxim. *Opulàster Amurénsis,* Kuntze). Similar to the former, higher and of more vigorous growth: lvs. 3–5-lobed, with acute or acuminate, doubly serrate lobes, usually pubescent beneath, 2–5 in. long: fls. large, with grayish tomentose pedicels and calyx: pods tomentose, only one-third longer than calyx-lobes. June. Amurland.

P. capitàtus, Kuntze (Spirǽa capitata, Pursh. Opulaster capitatus, Kuntze. S. opulifolia, var. mollis, Torr. & Gray). Closely allied to O. opulifolia. To 20 ft.: lvs. somewhat larger, with serrate, more elongated lobes, tomentose beneath: pedicels and calyx tomentose. Ore. to Calif.—*P. malvàceus,* Kuntze. (O. pauciflorus, Heller. Neillia malvacea, Greene). To 5 ft.: lvs. slightly 3-lobed, with crenately and obtusely toothed lobes, usually pubescent: corymbs rather few-fld.: pods 2–3, not inflated, tomentose, about as long as sepals. Wyo., Idaho. B. M. 7758 (as Neillia Torreyi).—*P. monógynus,* Coult. (Opulaster monogynus, Kuntze. Spirǽa monogyna, Torr. Neillia Torreyi, Wats.). Similar to the preceding, to 3 ft. high: lvs. smaller, ¾-1¼ in. long, incisely 3-lobed, with incisely serrate lobes, usually glabrous: pods 1–2. Colo. to Calif. G.F. 2:5.

ALFRED REHDER.

PHYSOSTÉGIA (Greek, *bladder* and *covering;* referring to the inflated fruiting calyx). *Labiàtæ.* FALSE DRAGON-HEAD. Three or 4 species of hardy herbaceous perennials, native to America, with spikes of gaping fls. of purple, rose color or white. *P. Virginiana,* the dominant and most variable type, is frequent in gardens and is sometimes called the Obedient Plant because its corolla will stay for a while in whatever position it is turned, to the right or left. This plant and its varieties have had at least 7 colored plates devoted to them, a large number for any labiate. *P. Virginiana* is an elegant plant when well grown and it does best in a strong, rather moist, fertile soil. It forms large clumps 3–4 ft. high and blooms in July and Aug. Requires frequent division or replanting.

Generic characters: calyx bell-shaped, swollen and remaining open in fr., membranous, 10-nerved; teeth 5, equal; corolla 2-lipped, inflated above; upper lip concave, rounded, entire; lower lip 3-lobed, the middle lobe commonly notched; stamens 4, didynamous; anther cells parallel.

Virginiàna, Benth. (*P. Virgínica,* Hort.). Fls. an inch long, ranging from purplish red through rosy pink and lilac to white. B.M. 467. Mn. 7:81. F.R. 5:55. Var. **álba,** Hort., is a recent and beautiful white-fld. form. R.H. 1898:336.

Var. **speciòsa,** Gray, is a tall form with very acutely serrate lanceolate lvs. and dense-panicled spikes. A Texan form with erect, imbricated fls. B.M. 3386 (*P. imbricata*).

Var. **denticulàta,** Gray (*P. denticulàtum,* Ait.). A lower and more slender form with crenulate denticulate or obscurely serrate lvs. and more slender or loosely-fld. spikes. Middle Atlantic states. B.M. 214.

F. W. BARCLAY and W. M.

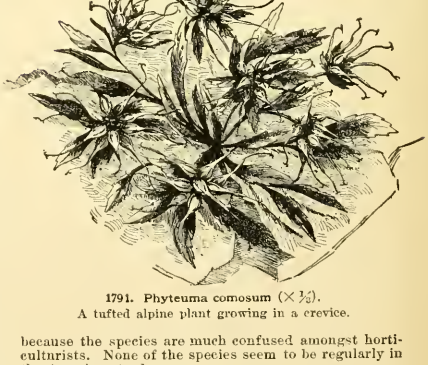
PHYSŪRUS (Greek, *bladder* and *tail;* from the purse or pouch-like spur). *Orchidàceæ.* A genus of about 20 species belonging to the category of Goodyera and Anœctochilus, and cult. for their foliage. Stem simple, erect, leafy: lvs. petiolate, ovate to lanceolate: fls. small, in a terminal raceme; petals and dorsal sepals cohering, galeate; lateral sepals free; labellum spurred, strongly concave above the entrance of the spur and abruptly contracted, middle lobe spreading or recurved; column short. Natives of the warm regions of Asia and Amer. The American species have their lvs. mostly spotted.

quercetícola, Lindl. (*Goodyèra quercícola,* Chapm.). Stem ascending, 6–12 in. high: lvs. ovate or oblong-ovate, thin, on slender petioles, spotted with silver-gray: spike densely fld.: sepals and petals oblong, obtuse: labellum concave, ending in a broadly ovate, acuminate and recurved point; spur pouch-like. Aug. Low shady woods, Fla. and westward. HEINRICH HASSELBRING.

PHYTÉLEPHAS (Greek, *elephant plant;* referring to the hard white seeds which can be worked like ivory). *Palmàceæ.* Prostrate or ascending palms of doubtful relationship, referred by some authorities to *Pandanaceæ.* They are dioecious, the fls. densely crowded in catkin-like spadices, without any perianth: leaf-segments acuminate. Species 15. South America.

macrocárpa, Ruiz & Pav. IVORY-NUT PALM. Caudex low: lvs. very long, pinnate. Peru, Venezuela. Gn. 24, p. 468.—Once adv. by Pitcher & Manda. Furnishes the vegetable ivory of commerce. Sometimes called Negro's Head. JARED G. SMITH.

PHYTEŬMA (old Greek name, meaning simply "a plant," used by Dioscorides for some mignonette-like herb). *Campanulàceæ.* HORNED RAMPION. Phyteumas are hardy herbaceous perennials, used for borders or alpine gardens. (See Figs. 1791, 1792.) The fls. are mostly shades of blue, more or less purple, rarely white. There are two styles of inflorescence, the globular and the long-and-narrow, the former being the more interesting. The showy feature of *P. comosum,* at first glance, seems to be a group of colored and much elongated pistils; but these pistil-like bodies are really corollas which usually show slits at their inflated base and are narrowed above into a very slender tube from which the style and stigmas are much exserted. In *P. comosum* the corolla never opens, but in all the others it finally splits at the top, making a spreading or wheel-shaped flower. The tubular stage seems the most attractive in the round-clustered species and the open stage, perhaps, in the oblong-clustered species. Phyteumas are natives of the Mediterranean region; about 50 species. These plants are little known in this country, but the following account is given because the plants are worthy and



1791. Phyteuma comosum (×⅓).
A tufted alpine plant growing in a crevice.

because the species are much confused amongst horticulturists. None of the species seem to be regularly in the American trade.

Phyteumas generally seed freely and may also be prop. by division, which is best performed in spring after growth begins. They thrive in ordinary garden

soil in either border or rockery. A very critical review of Phyteumas from the garden standpoint is given by "D. K." in Gn. 28, pp. 91, 92 (1885), from which the following points are abstracted. The smallest species, as *P. humile* and *pauciflorum*, should be planted by themselves or with other very dwarf alpines, so that they will not be smothered by taller and coarser subjects. The tallest, most robust and easiest species is *P. campanuloides*, large clumps of which attain 3 ft. in diam. and grow 2 ft. high. Such a clump makes a fine centerpiece for a flower-bed and blooms through July and Aug. Similar to it but inferior is *P. limonifolium*, with lighter blue fls. Both have oblong inflorescences, as also do *P. Halleri* and *P. spicatum;* the former growing a foot high in dry, sunny spots in a southern border, the latter attaining 1½ ft. on sunny rockwork.

At the other extreme as regards habit, ease of culture and style of inflorescence, is *P. comosum*, which in rockeries requires renewal every few years. A stock should therefore be constantly kept in pots. In the rockery it likes a shady position and in winter the crown should be covered with coarse sand; water freely from the time growth starts until flowering begins. Treated as a pot-plant it is more easily managed; use light soil well mixed with pieces of sandstone about the size of marbles and wedge the roots tightly between very hard stone; plunge the pots in cool material and give partial shade.

Of the other round-clustered types the following are very much alike: *P. orbiculare, Scheuchzeri, Charmelii* and *Michelii*. *P. hemisphæricum* thrives best in dry, stony places, particularly in the cracks of a crumbling brick wall, or on a steep slope with a southern exposure. It grows 1–6 in. high.

The botanical account following is mainly derived from DC. Prod. 7:450 and Koch, Syn. Flor. Germ. ed. III. 2:402. DeCandolle adopts the 3 sections made by G. Don, of which Section SYNOTOMA contains only the unique *P. comosum*. Section II, HEDRANTHUM, and Section III, PODANTHUM, are distinguished by the pores of the capsule, which are always 3 in the latter and situated near the apex, while in the former they may be 2 or 3 and situated near the middle. To Section III belong species 1, 7 and 8; to Section II belong all the others except *P. comosum*.

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1792. Two other types of inflorescence in Phyteuma (× ⅓). The loose-spiked *P. limonifolium* and the denser *P. scorzonerifolium*.

1. **canéscens,** Waldst. & Kit. (*Campánula Americàna*, Hort., not Linn.). Scabrous: stem unbranched: lvs. sessile; lower ones ovate, crenate-serrate, narrowed at base; upper ones nearly entire: fls. blue, short-peduncled, solitary, sparse. Hungary, Caucasus.

2. **comòsum,** Linn. Fig. 1791. The only species in the genus with umbellate inflorescence, and in which the corollas are not finally split at the apex. A decumbent, unbranched, glabrous plant native to the Alps: fls. pale lilac below, darker purple above. B.M. 6478. G.C. II. 14:177. Gn. 18, p. 245, copied in Gn. 28, p. 91; 44, p. 554, and R.H. 1882, p. 452. G.C. II. 26:81, copied in I.H. 34:11.

3. **scorzonerifòlium,** Vill. Fig. 1792. This and *P. betonicæfolium* should probably be regarded as botanical varieties of *P. Michelii*, but for clearness and for

horticultural purposes they may be considered as distinct species. A native of the Alps with fls. of sky-blue (B.M. 2066, erroneously as *P. betonicæfolium*) or purplish blue (B.M. 2271).

4. **Michélii,** All. This may also be distinguished from *P. scorzonerifolium* and *P. betonicæfolium* by having the calyx pilose at the middle, it being glabrous in the other two. A native of Mt. Cenis in Sardinia, with lvs. never cordate. Color of fls. not stated, probably blue.

5. **betonicæfòlium,** Vill. Root-lvs. cordate, long-stalked: bracts fewer than in *P. Michelii* and probably not reflexed. Eu. Not B.M. 2066, which is *P. scorzonerifolium*. Color of fls. not stated.

6. **spicàtum,** Linn. The color of the fls. (whitish or yellowish, green at tips) is highly characteristic: lower lvs. doubly crenate-serrate, long-stalked, cordate: spike oblong, 2–3 in. long. Eu. B.M. 2347.

7. **Hálleri,** All. Lower lvs. doubly and coarsely serrate, long-stalked: spike ovoid-oblong; fls. dark violet to white. Eu.

8. **limonifòlium,** Sibth. & Sm. Fig. 1792. This may be distinguished from *P. campanuloides* by the stem-lvs., which are fewer and pass into bracts: fls. light blue. The inflorescence is more sparse, but very dainty. Mt. Olympus, Dalmatia, near Naples. B.M. 2145 (*P. strieta*). L.B.C. 7:667 (*P. virgata*).

9. **campanuloides,** Bieb. Sufficiently distinguished in the key and under No. 8. Caucasus, Armenia. B.M. 1015 shows a stalk with over 60 fls., while *P. limonifolium* has only 12–30. Fls. dark violet.

10. **pauciflòrum,** Linn. Very dwarf: lvs. entire; root-lvs. short, obovate-lanceolate: bracts ciliate, entire or subdentate at base, never dentate at apex. Western Alps and Pyrenees. Fls. violet, according to Koch.

11. **globulariæfòlium,** Sternb. & Hop. Probably a var. of *P. pauciflorum* with larger stems, root-lvs. 2–4 lines longer and thrice as wide, and the bracts always entire at the base. Austrian Alps. Fls. violet.

12. **hemisphæricum,** Linn. Lvs. erect; root-lvs. subentire, linear or lanceolate-linear, much or little shorter than the stem: bracts ciliate, subentire: fls. blue, white or yellowish. Alps and Pyrenees.

13. **hùmile,** Schleich. Root-lvs. linear-lanceolate, narrowed at the base, upper ones remotely denticulate: bracts narrowly lanceolate from an ovate base, sharply toothed. Eu. Gn. 28:502. Fls. blue.

14. **Sièberi,** Spreng. (*P. Charmélii*, Sieb., not Vill.). Lvs. cordate, ovate or ovate-lanceolate, crenate: bracts ovate, acuminate, sharply serrate. Eu. Fls. violet, according to Koch.

15. **orbiculàre,** Linn. (*P. confusum*, Kern. *P. Austriacum*, G. Beck). Lvs. crenate; root-lvs. cordate or ovate; upper stem-lvs. linear: bracts subserrate. Eu. B.M. 1466 (*P. cordata*); fls. purple. L.B.C. 2:122.—A very variable species with forms ranging from 2–20 in. high.

16. **Charmélii,** Vill., not Sieb. Probably a botanical variety of *P. Scheuchzeri*. Bracts 3–6 lines long, erect or spreading. Alps. Here probably belongs the cut labeled *P. comosum* in Gn. 19, p. 419; 44, p. 554; and *P. orbiculare*, Gn. 28, p. 90.

17. **Scheùchzeri,** All. Bracts 18–24 lines long, reflexed or spreading. This and No. 16 differ from Nos. 10–15 inclusive in having few, narrow, unequal bracts instead of many broad ones which are about equal. S. Eu. B.M. 1797 (fls. purple).

P. Balbisii, DC., is near P. spicatum: stem 4–6 in. high: root-lvs. cordate: spike white, about 9–12 lines long in flower: bracts few, linear, shorter than the fl.: color of fls. not stated. Piedmont.—*P. Carestiæ* of Bir. is P. humile, No. 13, but P. Carestiæ of Vill. is P. serratum, a species probably nowhere in cult., and scarcely to be told from P. humile unless it has a larger stem, little wider lvs. and calyx glabrous instead of minutely ciliate.—*P. laxiflòrum*, R. Beyer and *P. Schellanderi*, are offered by the National Arboretum at Zoeschen. W. M.

PHYTOLÁCCA (a hybrid name: Greek, *phytos*, plant, and French *lac*, lake; referring to the crimson berries). *Phytolaccàceæ*. *P. decándra*, our common Pokeberry, is sometimes offered by dealers in native plants and its young asparagus-like shoots are sometimes used as a pot herb. Its flattish berries yield a crimson juice of a very distinct hue, but it has never been fixed for dyeing purposes. Children sometimes make red ink from the berries for amusement. Pokeberry is sometimes a troublesome weed. It is thoroughly naturalized in Europe. It has been used to give color to pale wines, but its use for this purpose is injurious and in Portugal is prohibited by royal decree. The roots are emetic, purgative and somewhat narcotic. The word "poke" is supposed to come from the American Indian word *pocan*, which apparently referred to any plant yielding a red or yellow dye, as pokeweed or bloodroot. In President Polk's campaign his followers wore leaves of pokeweed.

In collecting young shoots for greens, care must be taken not to include any portion of the root, as this would give a bitter taste and might cause serious illness. Small pieces of the root eaten by mistake for horse-radish or turnip have caused serious and in some instances fatal cases of poisoning. The seeds are also poisonous.

Phytolacca is a genus of about 10 species of tropical shrubs, herbs or trees, sometimes climbers: lvs. alternate, sessile or petiolate, acute or obtuse, entire: fls. small, greenish white, borne in long racemes which are at first terminal but by further growth of the stem come opposite the lvs.; calyx of 4 or 5 persistent rounded sepals; stamens 5–15: ovary of 5–15 distinct or somewhat united carpels: fr. a fleshy berry; seeds 1 in each cavity.

1793. Pokeweed—Phytolacca decandra (×¼).

decándra, Linn. POKEBERRY. POKEWEED. POKEROOT. Also called Scoke, Garget, Pigeonberry and Inkberry. Fig. 1793. A glabrous, strong-smelling, perennial herb, 4–12 ft. high: root large: lvs. oblong-lanceolate or ovate-lanceolate, acute, petiolate: racemes 2–8 in. long: stamens 10: ovary 10-celled: berries nearly ½ in. across, ripe Aug.–Oct. Me. to Minn., south Fla. to Tex. B.M. 931. D. 93. Gn. 21, p. 179. Mn. 1, p. 53.—Common in clearings. A variegated form, once cult. for ornament, is shown in R.H. 1887, p. 16, the lvs. light green above often shaded rose and more or less margined white, beneath pale rose to violet.

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Picea alba (or P. Canadensis). Maxwell's Golden variety

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