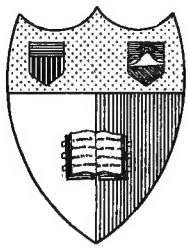


THE FAMILIES

— OF —

FLOWERING PLANTS.

BY

CHARLES LOUIS POLLARD, A. M.,

ASSISTANT CURATOR, DIVISION OF PLANTS,

UNITED STATES NATIONAL MUSEUM.

SUPPLEMENT

TO

THE PLANT WORLD.

VOLS. III, IV AND V.

1900--1902.

THE PLANT WORLD COMPANY,

WASHINGTON, D. C.

CONTENTS.

*By an error in numbering, Chapter VII is omitted from the text.

LIST OF TEXT FIGURES AND PLATES.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.*

By Charles Louis Pollard.

INTRODUCTION.

A question frequently asked by those interested in nature and nature-study is how a knowledge of plants may be obtained without the expenditure of time and trouble involved in a complete course of systematic and structural botany. It is a problem seemingly difficult of solution, but one that nevertheless commands attention, since the highest province of all science is the exposition of the facts of nature. Critical and technical study of any branch of biology is valueless if the world at large is not to profit by the researches of the scholar.

Many attempts have been made to meet this growing demand for popular botany. There are countless volumes designed to instruct the layman and to give him a casual acquaintance with the flowers of field and wayside. Most of them administer, under the sugar-coated guise of popular language, a bitter pill of meaningless names and descriptions, while the dose is often made more unpalatable by numerous and wholly superfluous extracts from the poets. The folk-lore of plants is a distinct branch of botany, and a book which aims to describe the plants themselves should avoid all digressions. In an effort to simplify the technical language of the science, the device of classifying plants by artificial methods, such as the color of their flowers, the situations in which they grow, etc., has been attempted, but the unwary reader, in pursuing this course, is likely to be led into snares. Color and habitat are variable characteristics, and acquaintance with a given plant is to be gained only by familiarity with its appearance and an understanding of its relationships. There is often a clear conception of individual genera, even among those who have no comprehension of how genera are grouped. Thus nearly everyone can recognize an oak tree, the oaks forming a very distinct natural genus, while most persons can

*A series of articles under the above caption was begun in the first volume of The Plant World, but extended only through the more important families of the Monocotyledons. The treatment at that time was necessarily very brief, and in the interests of completeness it has been deemed advisible to start the series anew, including illustrations and much additional text.

even distinguish certain species, as the white oak, the red oak, or the black jack. On the other hand, comparatively few of those unlearned in botany would know that the oak, the chestnut and the beech are members of the same family.

The aim of the present work is, therefore, to present an account of the families of flowering plants, giving a brief popular description of the characters of each, an outline of the geographical distribution, and a statement of the economic, ornamental or medicinal uses wherever these are important. As far as possible, some familiar generic type will be selected for illustration in each family.

CHAPTER I.

General Classification.

The flowering plants form a subkingdom known to botanists by various designations. The term at present generally accepted in this country is Spermatophyta, which is derived from two Greek words signifying seed and plants, in allusion to the fact that they bear seed rather than spores. Recent histological researches have demonstrated, however, that there is a distinct homology between the reproductive organs of the lower groups in the vegetable kingdom and those of the flowering plants, so that the word seed as contrasted with spore is a term of greater convenience than scientific accuracy. Another name for the flowering plants, which will be found in most of the older manuals, is Phanerogamia, a word also of Greek construction, signifying visible reproduction, in allusion to the fact that the latter process is effected by distinct floral organs. The modern German systematists have adopted a compound term Embryophyta Siphonogama, which signifies plants developed from an embryo and accomplishing fertilization by means of a pollen tube which sprouts from the pollen grain. For detailed explanations of the reproductive process in plants the reader is referred to the various standard text books on vegetable morphology and physiology; but in order that certain distinctions in classification may be more clearly brought out, it is necessary at this point to give a few definitions of the essential organs involved.

Sexual reproduction in plants is effected by the union of male and female elements contained in distinct organs known as sporophylls. The male sporophyll bears microsporanges containing numerous mi-

crospores, which are the active agents in fertilization. The female sporophyll bears macrosporanges containing macrospores. The latter, when fertilized, develop embryos, which become ultimately new individuals. Among the flowering plants these various organs have received special designations somewhat more familiar in general usage. The male sporophyll is known as a stamen, the microsporange as an anther-sac, one or more of which constitute an anther. The female

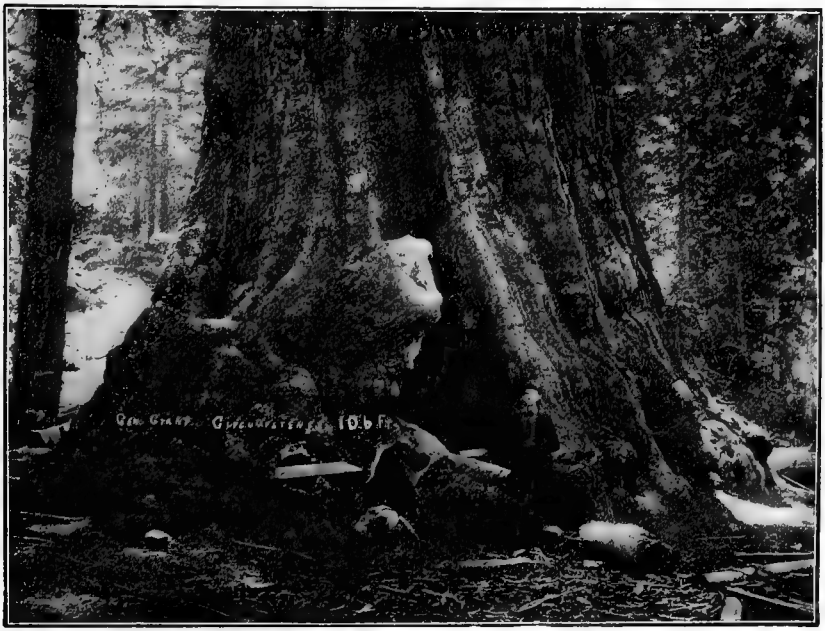


FIG. 1.—Base of a Californian Sequoia or "big tree," which represents a vanishing type of gymnospermous vegetation. (After Pinchot, Primer of Forestry, Bull. 24, Div. of Forestry, U. S. Dept. of Agric.).

sporophyll consists in the majority of flowering plants of a specially modified leaf called a carpel, which serves as a pouch to contain the macrosporanges or ovules. The carpels collectively form a structure known as an ovary, which is said to be monocarpellary or polycarpellary according to the number of divisions it contains. Each ovule includes a single macrospore or embryo-sac, and the fertilized ovule becomes a seed, the ripened ovary and its contents a fruit. A flower, on the other hand, or rather the conspicuous portion thereof (calyx and corolla) is merely a group of modified leaves serving as a protection to the enclosed stamens and ovary, which are vital organs. The showy

coloration of these leaves, which are frequently called by the general name of perianth, the presence of nectar-glands, ets., are devices to attract insects and insure proper fertilization.

The Spermatophyta are divided into the two following classes, the characters of each being appended:

CLASS I. ANGIOSPERMAE. [Greek, signifying covered seeds.] Plants having their ovules enclosed in a sac or ovary formed of one or more carpels. Fertilization effected by the growth of a tube from the pollen-grain after it has lodged on the apex of the ovary (stigma); this tube penetrates a small opening in the ovule, and through it the contents of the pollen-grain are transferred to the ovule.

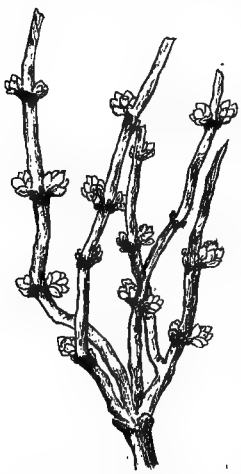


FIG. 2.—Branching stem of an Ephedra (family Gnetaceæ) showing the flower clusters.

CLASS II. GYMNOSPERMAE. [Greek, signifying naked seeds]; Plants having their ovules borne exposed on the surface of a scale. Fertilization effected either by the growth of a pollen tube or by the direct contact with the ovule of small moving bodies known as antherozoids, analogous to the spermatozoids in animals; these are discharged from the ripe pollen grain after it has lodged on the female sporophyll.

CHAPTER II.

The Class Gymnospermae. (*Fig. 1.*)

The Gymnosperms, as they are commonly called, contain all of our familiar evergreen coniferous trees, and therefore constitute a prominent feature of the forests in the colder temperate regions. The class is of great interest, not only by reason of its antiquity, but because it represents a vanishing type. Not more than 450 species of gymnospermous plants are now known to exist, while in Cretaceous and Tertiary times the group was much greater. Certain genera like Sequoia, containing the redwoods and big trees of California, at present restricted to a small strip of territory on the Pacific coast, were formerly abundant in many different geological horizons of the country. The gymnosperms represent the lowest type of flowering plants, making a close approach in the details of their mode of fertilization and devel-

opment to some of the flowerless plants, while the absence of differentiated organs, such as well-marked flowers or floral leaves, emphasizes the same condition.

The Gymnospermae include four orders, the Gnetales, Cycadales, Ginkgoales and Coniferales or Coniferae, besides several fossil orders.

ORDER GNETALES. (FIG. 2.)

This group includes the single family Gnetaceae. The average reader is not likely to meet with the plants comprised in the family. Of the three genera, Gnetum, with 15 species, is native of tropical

FIG. 3.—A cultivated Cycad (family Cycadaceæ) showing the crown of leaves and palm-like stem.

South America and portions of the Old World; Ephedra, comprising 20 species, is found in Mexico, South America and Asia, a few species reaching the extreme southwestern United States, while Tumboa, a genus of a single species, is restricted to a small area on the west coast of Africa. Gnetaceous plants as a rule are shrubs, the leaves either opposite or reduced to small scales. The flowers are borne in dense spikes, and are dioecious, that is, the male and female sporophylls occur on different plants. The floral envelope or perianth is small and membranous or scaly in texture, bearing little resemblance to a flower in the ordinary sense. There is great difference in habit; many

Gnetums are woody vines or lianas; Ephedra consists of erect shrubs with green or yellowish articulated branches quite destitute of leaves, while the peculiar Tumboa has a short trunk only a foot high, but several feet in diameter, from which depend two long strap-shaped leaves of so firm a texture that they endure for many years. The Gnetales possess no economic and little ornamental value. The young herbage and the berry-like fruit of *Gnetum Gnemon* is said to be eaten as a vegetable in India.

ORDER CYCADALES. (FIG. 3.)

This order, like the last, is restricted to a single family, the Cycadaceæ or Cycad family. The group is of special interest to the botanist, in view of the peculiar method by which fertilization is effected, mention of which has been made above. Cycads were abundant in prehistoric time, as is evidenced by the large quantities of well-preserved trunks found in the cretaceous deposits in Maryland and other localities. The genera are nine in number. Of these, two are Mexican, one Cuban, two African, one Australian, and the remainder are distributed through the tropics of both hemispheres. The genus Cycas has a well known representative in cultivation, *Cycas revoluta* of Japan, It is palm-like in appearace, having a thick short trunk and a crown of of handsome pinnate leaves of firm texture. Zamia is represented by two native species in Florida, where they are known as the coontie or Florida arrowroot. They are low plants, rarely exceeding a foot in height, and cover large tracts in the dry barrens. The leaves are not unlike those of a coarse brake or fern, and the thick erect, mostly subterranean stems abound in starchy matter from which a very good grade of arrowroot is obtained.

The inflorescence of Cycads is dioecious, like that of the Gnetads. The male and female flowers are produced separately in dense cones, and consist merely of anthers and ovules without any perianth, borne on thick scales. The seeds are either hard or with spongy outer covering. Although our cultivated cycads and the native species of Zamia above referred to are dwarf plants, yet in tropical regions members of this group are often tall in stature, with unbranched trunks resembling those of palms, and large crowns of pinnate leaves.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

ORDER GINKGOALES. (Fig. 4.)

THIS strange group is limited to a single family, Ginkgoaceæ, the latter moreover consisting of a single genus, *Ginkgo*, with one species, *G. biloba*, the ginkgo or maidenhair tree of China and Japan. Though formerly of rare occurrence in cultivation here, the tree is now frequently used to shade parkways and avenues, though it is not hardy in a severe climate. It is of conical outline, very symmetrical, with thick, slender-petioled irregularly fan-shaped leaves, often more or less lobed or incised at the broad outer margin, and wedge-shaped at the base. The plants are dioecious, separate individuals bearing the male and female inflorescences; a spray of leaves with the staminate flowers is shown in Fig. 4. The fruit is bright yellow in color, similar in appearance to a cherry, and fleshy in texture, with a hard central seed of stone; it is also distinguished for its nauseating odor. One of the finest plantation of these trees in this country is to be observed along the avenue leading up to the Department of Agriculture building, in Washington. During the summer, when they are clothed with their full wealth of foliage, these ginkgos possess a unique beauty which is unrivalled by any other ornamental shrub or tree.

Fig. 4.—Young shoot with staminate flowers, and fully developed leaf of the maidenhair tree (*Ginkgo biloba*).

ORDER CONIFERAE.

We have now reached the largest and by far the most important group among the Gymnosperms, comprising as it does, some of the most valuable timber trees in the world. In referring to the pines, spruces and junipers of our northern forests the average individual is apt to use the terms "evergreen" and "coniferous" somewhat loosely and interchangeably. An evergreen plant is merely one which retains its foliage until after the new growth has begun to develop. A conifer, on the other hand, is a plant belonging to the order Coniferae, and so named on account of the characteristic fruit; thus while most conifers are evergreen and a large part of our evergreens in temperate climates are conifers, it will be seen that the two terms are not synonymous. This cone-fruit varies greatly in size, shape and structure in different genera, and there is even great diversity among the species of a single genus, as will be seen on reference to Fig. 5, which represents the cones of

FIG. 5.—Cones. Beginning at the left, Coulter's pine, Western white pine, Eastern white pine, Knob-cone pine, Foxtail pine, Pitch pine, Lodge-pole pine, Red fir, Short-leaf pine, Eastern hemlock, and Eastern arbor-vitae. (After Pinchot, Bull. 24, Div. of Forestry, U. S. Dep't of Agric).

several pines. A cone consists of a central axis bearing adjoining or overlapping scales, which may be hard and woody or fleshy in texture, The male flowers of conifers usually resemble catkins in appearance; they consist of scalelike leaves or bracts bearing the pollen-sacs beneath. The ovules are likewise borne on or within the scales of the cone, and ripen into nutlike fruits. The wood structure in the conifers is of interest to the student of plant anatomy, the wood being uniform

in texture, without the ducts (known technically as tracheids) which traverse ordinary woods; it is freely permeated, however, by resin canals. The foliage of conifers is usually scale-like or needle-shaped, though sometimes exhibiting broad and expanded blades. The geographical distribution of the trees belonging to this order is quite extensive, although marked peculiarity is shown in individual groups. The largest genera range through the temperate regions of both hemispheres, while many of the smaller genera are restricted to a very limited territory. The reader interested in this phase of the subject will do well to consult Professor Coulter's article in Vol. III, No. 2, of THE PLANT WORLD, which discusses the distribution of individual groups. In

FIG. 6.—Spruces bordering a peat bog. Farther back are tamaracks and pines. The flowers seen in the bog are those of the snake-mouth orchid (*Pogonia ophioglossoides*). (From MacMillan's "Minnesota Plant Life" by courtesy of the author).

respect to habitat, coniferous trees usually present well marked areas or zones; thus everyone is familiar with the tamarack swamps of the north, the cypress swamps of the south, and the tracts of pine woods where a single species is the dominant type, in many parts of the country. This is well illustrated in Fig. 6.

After these general considerations we may proceed to examine the various groups into which the Coniferae are divided. There are two

families, the Pine (Pinaceæ) and Yew (Taxaceæ). It will be remembered that the other orders of Gymnosperms, namely the Cycadales, Gnetales and Ginkgoales consisted each of a single family.

PINACEAE, the PINE FAMILY. These are distinguished mainly by the fruit, which is a true cone with distinct scales, although these are sometimes coherent into a structure closely simulating a berry, as in the junipers. The ovules are enclosed and ripen within these scales. The Pine family is itself divisible into four well-marked tribes, which those familiar with different types of our native and cultivated conifers will have no difficulty in recognizing. These are, the *Araucarieæ*, or Norfolk Island pines; the *Abietineæ*, including pines, firs, spruces and hemlocks; the *Taxodieæ*, containing the Sequoias and bald cypresses; and the *Cupressineæ*, with the true cypresses and junipers.

Tribe Araucarieae.—Two genera, *Agathis*, with 4 species, natives of Australia and Malaysia; *Araucaria*, with 10 species, natives of South America and Australasia. The former genus consists of the kauri-pines, well known to Australian lumbermen. *A. australis* yields dammar resin or gum dammar, an important article of commerce. *Araucaria* is familiar from the dwarf cultivated specimens seen in florists' windows; the foliage is of a rich dark green hue and is arranged symmetrically in horizontal whorls, one above another. In their native habitat these trees attain lofty proportions.

Tribe Abietineae.—Eight genera, of which the most important are, *Pinus*, the pine, with 70 species of wide distribution; *Cedrus*, the cedar of Lebanon, with 3 Asiatic and African species; *Larix*, the larch, with 8 species; *Picea*, the spruce, with 12 species, also widely distributed; *Tsuga*, the hemlock, with 6 species; and *Abies*, the fir, with about 20. This group includes most of the valuable coniferous timber trees. The wood is of every variety, from the familiar soft white pine to the hard and tough cedar. The genera from which the most useful woods are secured are *Pinus*, *Picea*, *Abies* and *Cedrus*. Turpentine, a substance now constantly used for various purposes in the arts, is the product of various pines, notably in the United States of the long-leaved pine (*P. palustris*); in Europe of the Scotch pine (*P. sylvestris*) and the Corsican pine (*P. Laricio*). Various resins are obtained from other genera of the group, the well known spruce gum, which is now practically supplanted in the trade by artificial preparations, being a familiar example. Terebinth, a balsamic resin, is derived from several firs and pines; it is to this that the delightful frag-

rance of the fir-balsam (*Abies balsamea*) is due. Fig. 7 illustrates the cones and cone-scales of several native spruces, while Fig. 8 affords a view of a northern tamarack swamp.

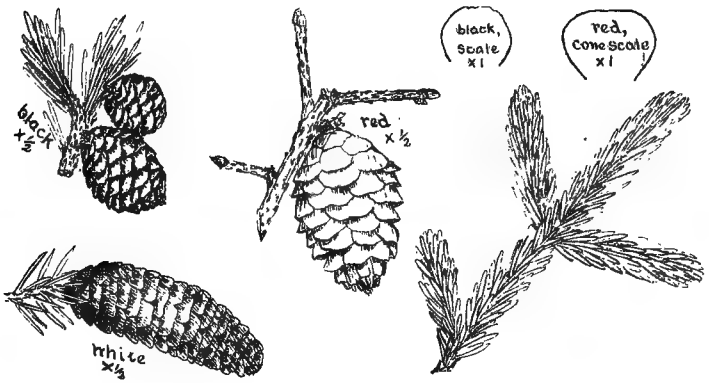


FIG. 7.—Branch, cones and cone-scales of various spruces. (From Bull. 73, Vermont Agric. Exp. Station, by Miss Anna Clark. Loaned by the Univ of Vermont).

Tribe Taxodieae.—Seven genera, each with one or two species, all natives of eastern Asia except *Sequoia*, with 2 Californian species, and *Taxodium*, the bald cypress, with one in Mexico and one in the eastern United States. The members of this tribe furnish conspicuous examples of the vanishing type of gymnospermous vegetation to which we have already made reference (See Supplement, page 4). The stately Sequoias, monarchs of the Californian forest, are probably doomed to ultimate extinction, though the redwood (*S. sempervirens*) is much more abundant than the giant sequoia (*S. Washingtoniana*), which exists now only in a few carefully preserved groves. The enormous dimensions attained by these trees are well shown in Fig. 1 of the Supplement. The bald cypress (*Taxodium distichum*) is familiar to every one who has made a pilgrimage to the Dismal Swamp of Virginia or to any of the large tidal swamps along the southeastern Atlantic coast. Though often grown as a shade tree in southern cities it needs a wet soil in order to thrive, and in such situations it usually develops the remarkable "knees" to a wonderful extent. These knees are woody projections thrown up around the base of the trunk, conical in outline, with a rounded apex, projecting sometimes a foot or more above the surface of the swamp. The bole of the trunk itself is often enormously enlarged, serving as a buttress to anchor the tree firmly in place. A similar enlargement may be seen in many other

trees growing in such situations, and illustrates an adaptation to environment of which plant life furnished so many interesting examples. The purpose of the knees is not only to furnish the tree with props,

FIG. 8.—Tamarack swamp with border of sedges. (From MacMillan's "Minnesota Plant Life" by courtesy of the author).

but to admit air to the roots, as is proven by the fact that the trees are frequently killed when flooded above the tops of the knees.

Tribe Cupressineae.—Nine genera, the species of which are very widely distributed. The most important are *Callitris*, with 15 African and Australian species; *Libocedrus*, with 8 species in America and New Caledonia; *Cupressus*, with 12 widely scattered species; *Chamæcyparis*, with 4 in North America and Japan; and Juniperus, containing 30 species, distributed throughout the whole temperate zone. Several species of *Chamaecyparis*, particularly the Lawson's cypress (*C. Lawsoniana*) and the yellow cypress (*C. Nutkaensis*) both occurring on the Pacific coast, are valued both as timber trees and as ornamental shrubs in cultivation. *Cupressus* and *Libocedrus* also furnish valuable timber. An African species of *Callitris*, the sandarac tree, yields sandarac, which is a white resin, used both as an incense and in

the preparation of a light varnish. The wood of this tree is of a handsome mahogany color, and is extensively used in Morocco in the construction of mosques and similiar buildings. The junipers have cones in which the scales cohere into a fleshy berry, well known as "juniper berries." These are usually highly aromatic, and those of the common juniper (*J. communis*) yield a volatile oil used in medicine as a diuretic and stimulant; they are also employed in the manufacture of gin. The wood of our common red cedar (*J. Virginiana*) is almost exclusively used in lead-pencil manufacture.

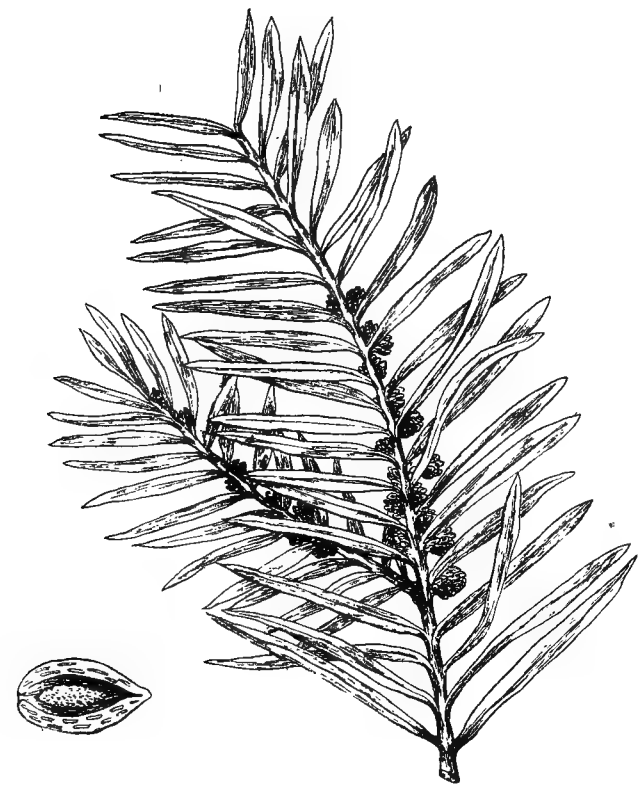


FIG. 9.—Leaves and staminate flowers of the stinking cedar (*Tumion taxifolium*). Also section of fruit: the whole reduced one-half.

TAXACEAE, the YEW FAMILY. This is a much smaller group than the Pinaceae, consisting only of two tribes. The family is distinguished chiefly by the fruit, which is not a perfect cone, the ovules projecting beyond the scales or the latter wholly absent; the seed is

usually invested with a hard or pulpy integument known as an aril. Frequently the fruit resembles a plum in having an outer fleshy coating and a hard seed within. The foliage exhibits more diversity than in the Pine family.

Tribe Podocarpeae.—Four genera, three of eastern Asia, and one containing a single Patagonian species. The largest genus, *Podocarpus*, includes about 40 species, several of which are cultivated as ornamental shrubs.

Tribe Taxeae.—Four genera, two confined to eastern Asia and Malaysia; the others are *Taxus*, the yew, with about 8 species of temperate regions; and *Tumion* (*Torreya*) an interesting genus with a remarkable distribution, namely, one species in Florida and California, and two in China and Japan. The English yew (*Taxus baccata*) be comes a large forest tree, and is highly valued for its timber, as is also the Oregon yew (*T. brevifolia*). The yews of the eastern United States, on the other hand, are low straggling shrubs, ornamental only for their red, cup-shaped fruits, which are eagerly sought by birds. The stinking cedar of Florida (*Tumion taxifolium*) is one of the rarest North American trees, being confined to a linited area on the Apalachicola river. The name is in allusion to the odor exhaled by the herbage when bruised. The foliage is dark green and very handsome (see Fig. 9). The fruit is large and plum-like in appearance.

SUPPLEMENT.

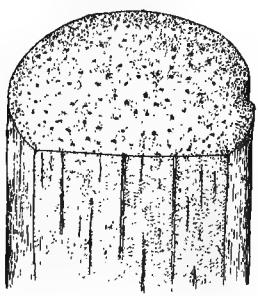
THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER III.

Class Angiospermae.—From Screw-pines to Tape-grass.

WE have already discussed and explained the differences between the two classes of flowering plants known as Angiospermae and Gymnospermae (see Supplement, page 4). The Angiospermae are divided into two general sections, each of which may be easily recognized, and which are of such importance that their names and characters should be memorized:



From Coulter's "Plant Relations." Copyright, 1898, by D. Appleton & Co.

FIG. 10.—A corn-stalk, showing longitudinal and cross-section, with the scattered bundles.

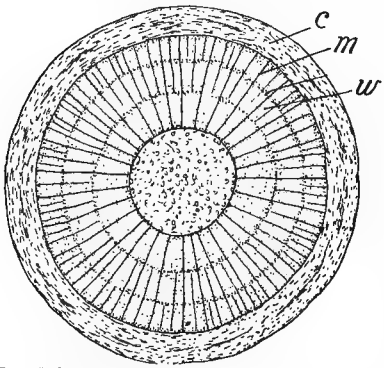
1. Monocotyledons. Plants that produce on germination a single seed-leaf or cotyledon. Leaves for the most part with veins running from base to apex, or from midrib to margin in parallel series. Part of the flower nearly always in threes or some multiple of three. Wood of the stem with no annual rings or layers. Examples, palms, lilies, grasses, sedges. (See Fig. 10.)

2. Dicotyledons. Plants that produce on germination usually two seed-leaves or cotyledons. Leaves with reticulated or netted veins. Parts of the flower rarely in threes, mainly in or fives fours, or some multiple of these numbers. Wood of the stem with marked annual rings or layers. Examples, maples, elms, buttercups, daisies, peas. (See Fig. 11.)

The great mass of our northern vegetation, including almost all the native trees, belongs to the second class. The Monocotyledons are the simplest and lowest of the flowering plants; this is proven not only by their structure, but by the fact that in past geological time

they appeared on the earth's surface in advance of the Dicotyledons.

The three Monocotyledonous orders which will be discussed in this paper consist entirely of aquatic or marsh plants, most of them with inconspicuous flowers and little or no economic value. (See Fig. 12.) The Pandanales are herbs, shrubs or trees, their flowers with a perianth composed merely of bristles or chaffy scales. The Helobiae (so named in allusion to their marsh loving propensities) are all herbs, with a fleshy green or corolla like perianth; while the Triuridales, comprising a single family, consist mostly of saprophytic herbs, or plants deriving their subsistence from decaying vegetable matter, and thus wholly destitute of leaves.



From "oulter's "Plant Relations."
Copyright, 1899, by D. Appleton & Co.

FIG. 11.—Section of box-elder twig showing the annual rings of growth, the vascular region (w) the pith rays (m) and the cortex (c).

FIG. 12.—Zones of aquatic vegetation. In the center pond lilies; at the edge smartweed; farther back cat-tails, blue flags, sweet flags and sedges; still farther back soft turf with grass, moss, sedges and milkweed. (From MacMillan's Minnesota Plant Life, by courtesy of the author.

ORDER PANDANALES.

Family Pandanaceae.—Screw-pine Family. Two genera, natives exclusively of the tropics of the Old World. The plants are distinguished by their long and attenuate leaves of firm texture like those of a century plant; the margins and keel are usually spiny. The small flowers, quite destitute of any sort of perianth, are subtended by numerous bracts and are borne in dense clusters; they consist of many stamens and an ovary composed of a single carpel, succeeded by a large and fleshy fruit with a hard or woody external surface. Several species of *Pandanus* are common foliage plants in greenhouses, their long arched leaves and graceful habit rendering them particularly appropriate as center pieces in groups. In their native habitat the plants form impenetrable swamps, producing numerous interlacing aerial roots like those of the mangrove.

Family Typhaceae.—Cat-tail Family. This contains but a single genus, *Typha*, which is always easily recognizable. The plants are stout and reed-like in habit, with long sword-shaped leaves and wand-like spikes which consist of innumerable tiny flowers, reduced to mere stamens and pistils, with no perianth or floral envelope, but with numerous intermixed bristles. The upper portion of the spike, at flowering time, is lighter in color and less dense; this is composed entirely of stamens, which soon fall away, leaving the pistils below to form a cotton-like mass in fruit. The flowers are thus said to be monoecious (Greek, dwelling in one household), because the two sexes, although separate, occur on the same plant. *Typha* contains abous 12 species, widely distributed in temperate and tropical reigons, though always found in marshes. In many of our western states the spikes are used as "swabs" for the purpose of cleaning lamp chim-

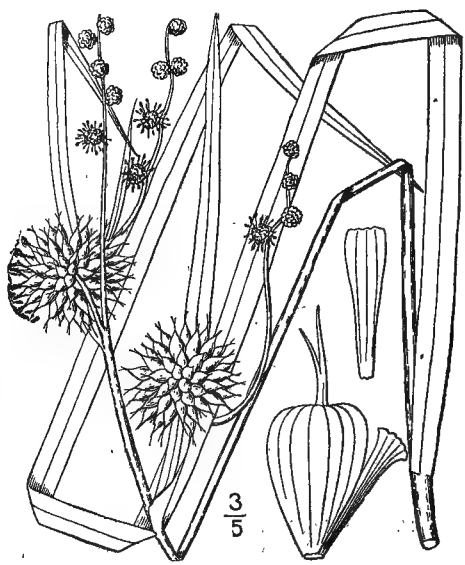


FIG. 13.—The broad-fruited bur-reed (*Sparganium eurycarpum*) showing flowering branch and a detached fruit enlarged. (After Britton and Brown, Ill. Fl. North U. S.)

neys. The pollen, which is produced in great quantities during the flowering season, is sometimes employed in place of lycopodium spores as an absorbent powder.

Family Sparganiaceae.—Bur-reed Family. This also consists of a single genus, *Sparganium*, and it was formerly included among the cat-tails. The plants possess an entirely different aspect, however; the flowers are monoecious, as in *Typha*, but they are borne in several globular heads on the upper branches of the stem, and not in a single terminal spike. (See Fig. 13.) The fruit is hard and nutlike, much larger than that of the cat-tail, and without any intermixed bristles, while the leaves are thin and grasslike. *Sparganium* contains about 8 species, natives of temperate regions; they are not known to possess any economic uses.

ORDER HELOBIAE.

Family Naiadaceae.—Pondweed Family. About 10 genera, widely distributed, of which Potamogeton is the only one of much size or importance, containing about 50 species, 30 of which occur in the eastern United States and a large proportion of them in New England alone. Slow streams and rather shallow ponds form the favorite haunts of these plants, whose smooth oval leaves floating on the surface of the water may be noticed in many such situations. All the pondweeds are immersed aquatics with slender, often branching stems and small greenish flowers usually borne in spikes; they are either perfect (having the stamens and pistils in the same flower), monoecious or dioecious, in some cases wholly destitute of floral envelopes, in others with a perianth of four distinct segments. In this latter respect it will be seen that they are exceptional among the monocotyledons, which it will be remembered are usually distinguished by the three-

FIG. 14.—Clasping-leaved pondweed (*Potamogeton perfoliatus*) with enlarged fruit and section of the latter. (After Britton and Brown, Ill. Fl. North. U. S.)

parted perianth. The ovary is composed of several distinct carpels which become small stone fruits or nutlets. A curious feature of the pondweeds, particularly in *Potamogeton*, is the difference in shape often exhibited between the immersed leaves and those that float on the surface of the water. Thus *P. Spirillus* has its floating leaves oval or elliptical, while its submersed leaves are narrowly linear; this peculiarity is the result of the plant's adaptation to the conditions under which it grows, the exposure to air and sunlight tending to the production of expanded blades. In species which grow wholly submerged there is no difference in the shape of the leaves. (See Fig. 14.) The genus *Aponogeton*, composed of about 15 Old World species, contains some beautiful ornamental aquatics, known as lattice-plants on account of the open lace-like tissues of their leaves, which appear as if pierced by many holes.

Family Scheuchzeriaceae.—(Juncaginaceae). Arrow-grass Family. Four genera and only about 10 species, of wide distribution. All are marsh plants, with rush-like or sedge-like leaves and small perfect flowers born in spikes or racemes. The perianth is in two series, thus showing traces of differentiation into a calyx and corolla; the ovary is composed of several carpels, slightly united. *Triglochin*, the best known genus, with three North American species, is found in salt marshes along the coast and in alkaline situations in the interior of the continent, its small greenish spike and linear or filiform leaves being quite inconspicuous.

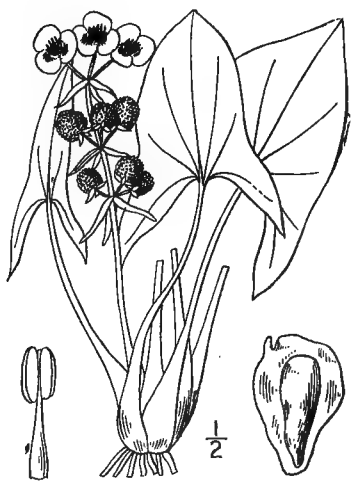
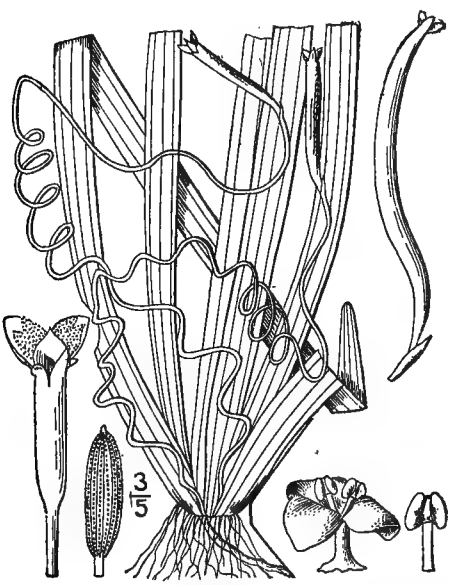


FIG. 15.—Arum-leaved arrowhead (*Sagittaria arifolia*) showing whole plant reduced with enlarged fruit and stamen. (After Britton and Brown, Ill. Fl. North. U. S.)

Family Alismaceae.—Water-Plantain Family. Thirteen genera and about 65 species, widely distributed in fresh water swamps. The plants are herbs with long petioled leaves and scapose flowers borne in broad panicles or racemes. The flowers vary greatly in structure, being perfect, monoecious or dioecious; but they are always borne in whorls on the peduncle, and possess a perianth, usually in two distinct series. The ovaries are often numerous, each carpel becoming a small

flattened achene somewhat like that of a buttercup. The plantain-like leaves from which the popular name of the family is derived are most conspicuous in *Alisma*, which is a familiar bog plant throughout the continent. In this genus the flowers are small and inconspicuous, but in *Sagittaria* they are often of some beauty, the inner perianth series, or corolla, consisting of three large white petals of the texture of crépe. *Sagittaria* is called arrowhead from the shape of its leaves, which exhibit great diversity of form, but in many species are more or less like an arrow or spear head in outline. (See Fig. 15.)

Family Butomaceae.—Water Poppy Family. Four genera, each monotypic, or consisting of a single species, and all exotics. The characters of the family, however, are well illustrated in the beautiful yellow water poppy (*Hydrocleys nymphoides*) so often cultivated in ponds and tubs. The plants are herbs with extensively creeping root-stocks, or branching stems, and scapose flowers, solitary in the water poppy and umbelled in the other genera; the flowers are perfect, with a perianth composed of calyx and corolla, the latter often conspicuous. The fruit resembles that of the arrowhead or water plantain, but the ovary contains more numerous ovules.



FAM. 16.—Tape grass or wild celery, (*Vallisneria spiralis*) showing enlarged staminate and pistillate flowers, also the fruit. (After Britton and Brown, Ill. Fl. North. U. S.)

Family Vallisneriaceae (Hydrocharidaceae).—Tape-grass or Frog's-bit Family. Fourteen genera and 40 species of wide distribution, chiefly tropical. The only genera occurring in American are *Vallisneria*, *Philotria* and *Halophila*. The family is distinguished mainly by the dioecious flowers, produced from the axils of enveloping bracts known as spathes; there is a small perianth composed of three to six segments. It is an interesting fact that *Vallisneria*, the true eel-grass or "wild celery", whose long ribbon-like

strands are often seen on sea beaches, furnishes the chief food for the wild ducks, and contributes much to the delicate flavor of the canvas-back. The mode of fertilization in this plant is remarkable. The staminate flower becomes detached while still in the form of a bud, and expands floating on the surface of the water; the liberated pollen soon reaches the pistillate flowers, whose long peduncles have brought them to the surface; after fertilization the scapes contract spirally, so as to bring the young fruit below the surface while it is maturing. (See Figs. 16 and 17.)

ORDER TRIURIDALES.

Family Triuridaceae.—Tailflower Family. Two or three genera and few species, entirely tropical. They are terrestrial and saprophytic herbs of small size, yellowish or reddish in color and entirely leafless; the flowers are monoecious, borne in racemes, or sometimes solitary; the perianth consists of a single series of three or more segments. The flowers are often fringed, while those of *Triuris* are provided with three long tail-like appendages to the perianth lobes, thus giving the name to the family. These little plants are interesting to the botanist, but they are of no economic value.

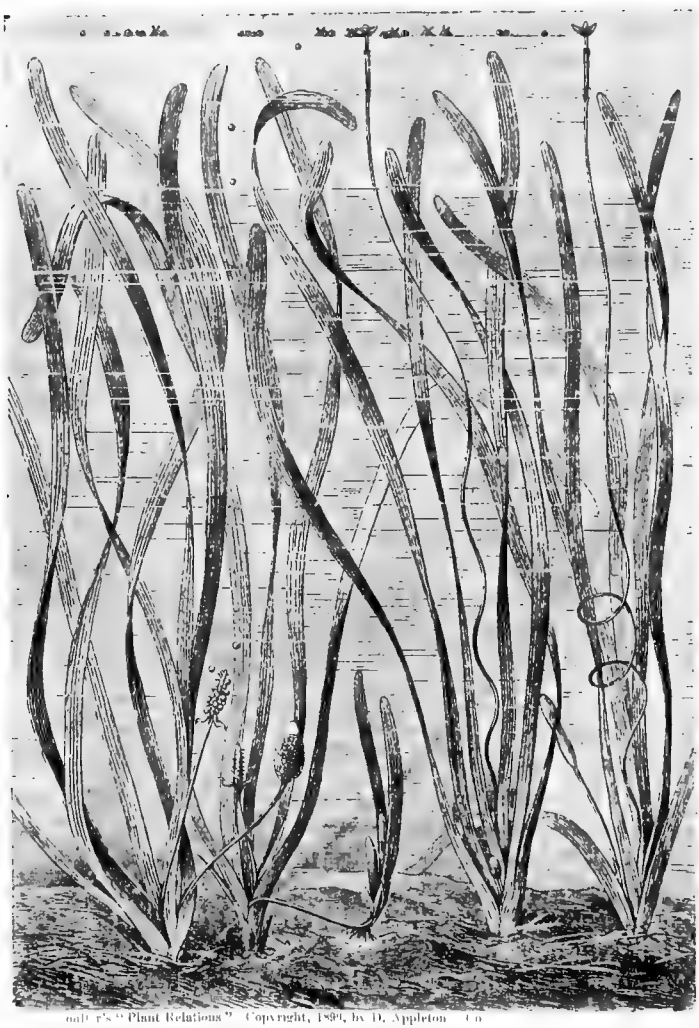


FIG. 17.—Tape-grass or wild celery (*Vallisneria spiralis*) showing habit of growth and mode of fertilization. (After Kerner.)

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER IV.

Order Glumiflorae.—The Grasses and Sedges.

THERE are probably no two families of flowering plants more likely to be confused by the amateur than the Gramineae and Cyperaceae, known popularly as the grasses and sedges. The farmer would designate both groups by the comprehensive term "hay", and would find examples of each in the mowings from salt marsh as well as from upland meadow. There are, however, important differences between the families, and since from the economic standpoint the grasses are of the highest value, while the sedges are nearly worthless, it is well to understand these differences thoroughly at the outset.

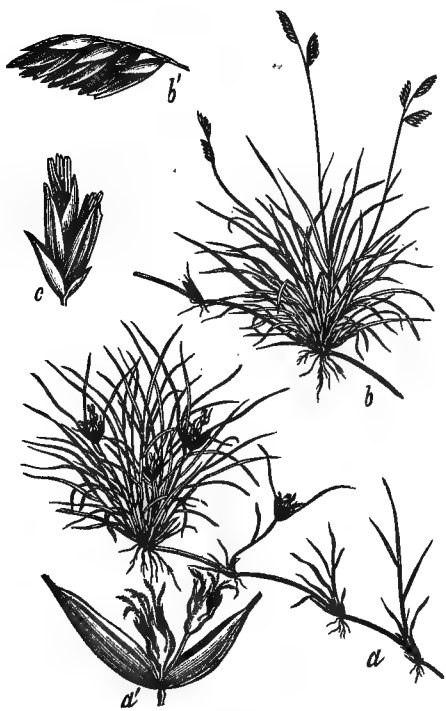


Fig. 18.—Buffalo grass, *Bulbilis dactyloides*. (After Scribner, Bull. No. 7, Div. of Agrost., U. S. Dept. of Agric.)

Family Gramineae (sometimes called *Poaceae*).—Grass Family. This is one of the largest families of flowering plants, over 300 genera and 3500 species being recognized. They are widely distributed in all countries, and present astonishing extremes in size from the diminutive herbaceous Phippsia of arctic re-

gions to the lofty arborescent bamboos of the tropics. The inflorescence consists of what are technically called *spikelets*, each of which is made up of small imbricated chaffy scales. Some of these scales are empty; others enclose the stamens, usually three in number, and the pistil; and each of these flower-bearing scales usually encloses an additional, very slender scale known as the *palet*. Every individual floret thus consists of the essential organs of reproduction, surrounded by two protecting scales; one or more of the florets are borne together on a slender axis, forming a spikelet; while the innumerable spikelets may be clustered together in a spike, as in timothy, or borne in an open branching panicle, as in red top, Kentucky blue grass, and many other species. The leaves of these plants are so well known that the term grass-like is common as a standard of comparison. At the junction of leaf and stem, where the base of the leaf usually forms a completely enwrapping sheath, will be noticed in most cases a peculiar membranous ring or protuberance; this is called the ligule, a name derived from its suggestion of a little thong or strap, and it is an indisputable proof, if present, that we have a grass and not a sedge or rush before us. The grass stem or *culm* is hollow, except at the joints.

FIG. 19.—Barnyard grass (*Panicum Crus-galli*). (After Britton and Brown, Ill. Fl. Northern U. S.)

Little need be said of the value of grasses for forage and pasturage; indeed they furnish nine-tenths of the subsistence of domesticated herbivorous animals, and with the

FIG. 20.—Forked Beard-grass (*Andropagon furcatus*). (After Britton and Brown, Ill. Fl. Northern U. S.)

possible single exception of *Lolium temulentum*, no species is poisonous or even injurious to stock. All of our cereals, wheat, rye, barley, oats, rice, maize, etc., are derived from various grasses, many of which have their wild relatives growing abundantly in our fields. Thus the sorghum of commerce belongs to the same genus as the dreaded "Johnson-grass" of the south (*Sorghum halepense*), one of the worst usurpers of cultivated lands.

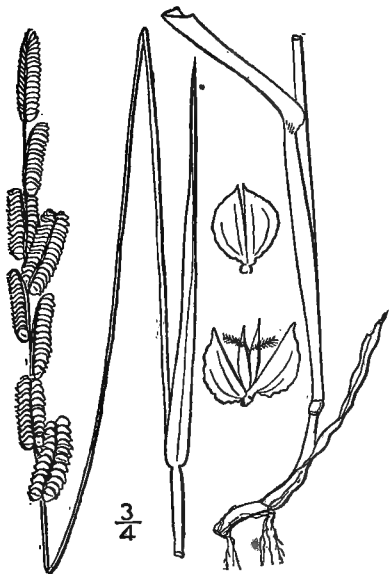
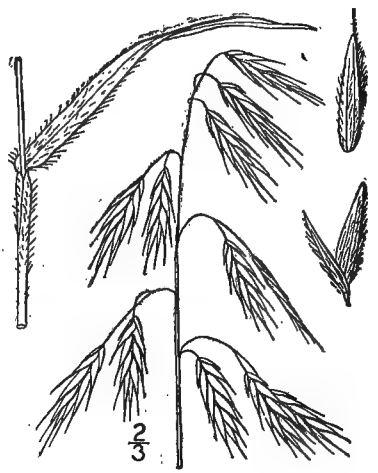


FIG. 21.—Beckmannia grass. (*Beckmannia erucaeformis*) (After Britton and Brown, Ill. Fl. Northern U. S.)

Its value as a source of food products alone would lend importance to the grass family; but besides their primary use in furnishing nutrition the grasses exhibit many economic uses. Some species are used for hat-plaiting, mat-weaving and basket-weaving; others furnish material for the paper industry, and the genus *Andropogon* contributes to the manufacture of perfumery.

The arborescent grass known as Bamboo (*Bambusa*) is a great factor in the industrial arts of oriental countries. Boats, houses, furniture, quill-work, fences, water-wheels, handles for tools, umbrellas, knives, and countless small objects of use and beauty will be remembered as formed from the tough tubes of this oriental grass, while the young shoots are preserved as sweetmeats, and lampwicks are made from the pith. Bamboo carvings rival ivory in their delicacy and durability, the polished joints of the plant serve as writing tablets for the natives of Sumatra, and even telescopes have been made of bamboo stalks.



FAM. 22.—Kalm's chess (*Bromus Kalmii*). (After Britton and Brown, Ill. Fl. Northern U. S.)

Many grasses with rapidly growing and branching rootstocks as the beach grass (*Ammophila arenaria*) share with numerous sedges the important function of sand-binders; that is, they serve to hold the drifting sands along the coast and prevent the soil from being carried away by wind and waves.

FIG. 23.—Creeping Panic-grass (*Panicum repens*. (After Scribner, Bull. No. 7, Div. of Agrost., U. S. Dept. of Agric.)

A number of species like the various pampas grasses of South America, the ribbon-grass (*Phalaris*) the "Job's tears," (*Coix lachryma*) and others are highly ornamental in cultivation, retaining their beauty when dried and cut. The use of several Andropogons in the manufacture of perfume has been mentioned; but it should be remembered that our own sweet vernal grass (*Anthoxanthum odoratum*) when cut, properly dried and placed between thin papers will exhale a delicate fragrance far superior to that of any sachet powder.

While enumerating the uses of this family we must reluctantly admit that it contains also some of the worst weeds known to farmers. The couch grass (*Triticum repens*) the crab grass (*Syntherisma sanguinalis*) and several others are extremely difficult to eradicate when they have once taken possession of the ground. Among the largest genera of the Gramineæ may be mentioned *Andropogon*, with about 200 species; *Paspalum*, with 300; *Panicum*, with nearly 800; *Agrostis*, 100; *Calamagrostis*, 150; *Danthonia*, 100; *Eragrostis*, 100; *Poa*, 200; *Festuca*, 250; and *Bambusa*, 50. The figures illustrate various distinct types, showing in each case enlarged views of the inflorescence as well as the habit of the plant; the general similarity of structure however, will be noticed throughout.

FIG. 24.—Wild rice, *Zizania aquatica*. (After Britton and Brown, Ill. Fl. Northern U. S.)

FIG. 25.—Minnesota Muhlenbergia (*Muhlenbergia ambigua*). (After Britton and Brown, Ill. Fl. Northern U. S.)

FIG. 26.—Timothy grass (*Phleum pratense*). (After Scribner, Bull. No. 7, Div. of Agrost., U. S. Dept. of Agric.)

FIG. 27.—Broom grass, *Andropogon Virginicus*. (After Scribner, Bull. No. 7, Div. of Agrost., U. S. Dept. of Agric.)

FIG. 24.—Wild rice, *Zizania aquatica*. (After Britton and Brown, Ill. Fl. Northern U. S.)

FIG. 25.—Minnesota Muhlenbergia (*Muhlenbergia ambigua*). (After Britton, Ill. Fl. Northern U. S.)

FIG. 26.—Timothy grass (*Phleum pratense*). (After Scribner, Bull. No. 7, Div. of Agrost., U. S. Dept. of Agric.)

FIG. 27.—Broom grass, *Andropogon Virginicus*. (After Scribner, Bull. No. 7, Div. of Agrost., U. S. Dept. of Agric.)

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER IV. (*Continued.*)

THE family Cyperaceae, or Sedge family, is less extensive than the Grass family, embracing 75 genera and about 2800 species, 700 of which are contained in the single genus *Carex*. Sedges are widely distributed over the globe, some genera being characteristic of arctic or high alpine regions, while others form impenetrable jungles or "brakes" in tropical swamps. The larger proportion of the species prefer wet ground, although many of our commonest forms may be found along dry roadsides or in upland meadows.

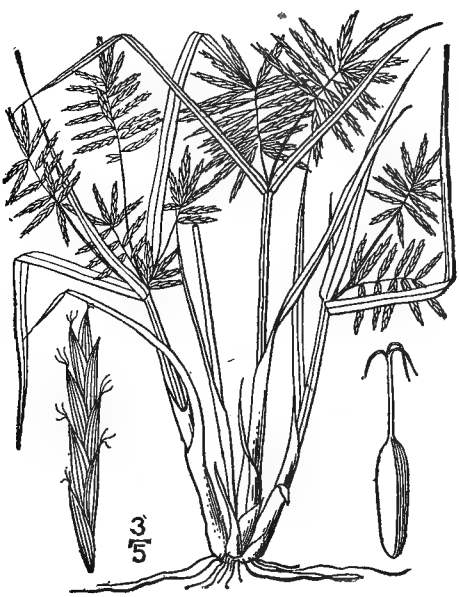


Fig. 28.—Straw-colored Cyperus (*Cyperus strigosus.*) After Britton and Brown, Ill. Fl. Northern U. S.

The economic uses of these plants are not very extensive. The stems of the common bulrush, *Scirpus lacustris* afford material for the manufacture of mats, baskets, and the so-called "rush-bottomed" chairs; while certain species of *Carex* and *Cyperus* are not without value as forage plants. Many sedges growing along the sea coast perform important service as "sand binders."

There are many points of similarity in floral structure between the sedges and the grasses. In

both the infloresence consists of spikes or panicles, made up of small spikelets; but the flower-bearing scale in a sedge is single, while in a grass it is double. Moreover the sedges often exhibit some traces of a floral envelope in the shape of a crown of bristles, while the grasses are quite destitute of perianth. The sedge leaves are sometimes flat and grass-like, sometimes slender and wiry, or "terete," as they are technically called. The little thong-shaped appendage called a ligule, borne at the junction of leaf and stem in grasses, is entirely wanting in the sedges; and finally, the latter family have stems that are solid and more or less three-angled. Figure 28 illustrates a species of *Cyperus* common in the eastern United States, and will afford a good idea of the general plan of structure in the group. Figures 29 and 30 represent types of the two large genera *Scirpus* and *Carex*.

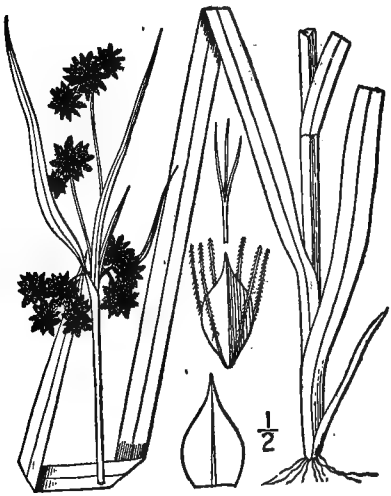


FIG. 29.—Dark green Bulrush (*Scirpus atrovirens*). After Britton and Brown, Ill. Fl. Northern U. S.

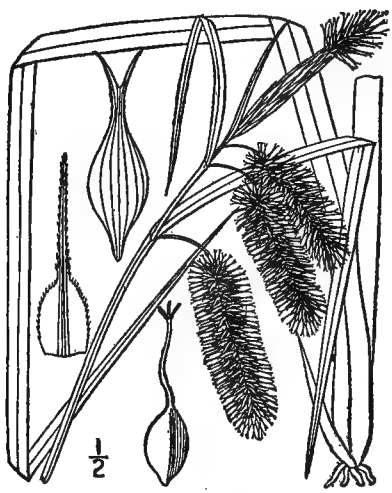


FIG. 30.—Bristly Sedge (*Carex comosa*). After Britton and Brown, Ill. Fl. Northern U. S.

CHAPTER V.

Order Principes. The Palms.

This order comprises but a single family, the Palmaceae or Palm family, an extremely well marked natural group of plants, so characteristic in their aspect that the term "palm-like" whether applied to leaf or trunk, is to most persons self-explanatory. The family consists entirely of trees and shrubs, and is now essentially tropical in its distribution, although there is geological evidence that palms were found throughout the United States before the glacial epoch. There are about 150 genera and 1000 species, of which seven genera are represented by one or more species each in the extreme Southern States and in Southern California, while two, the date and cocoanut palm, occur spontaneously as escapes from cultivation.

The palm stem is one of our most typical examples of the so-called endogenous structure among the Monocotyledons (See Supplement, page 15). A cross-section shows no annual rings or circles of wood, but a homogeneous mass of pith through which the bundles of woody fiber will be found irregularly distributed. Palms have no true bark, but the external rind is often very hard, and difficult to cut with an axe. The growth is from a terminal bud, and the leaves are produced in a graceful cluster at the summit of the stem; as the lower ones decay and fall off, their sheathing petioles remain, forming a fibrous network. The flowers are borne in dense, fleshy flower clusters to which the term *spadix* is applied; they are usually enveloped or subtended by a large tough bract called a *spathe.* The flowers or monœcious or dicœcious, the male and female sporophylls being borne separately on the same or different plants. We find in this family the first well-marked floral envelope, consisting of two series (calyx and corolla); it is usually leathery in texture, and green or yellow in color. The stamens are from three to six; and the fruit is either a drupe or stone fruit, as in the date, or a berry, as in the common cabbage palmetto of the South.

From the economic standpoint the palms constitute the most important family among the monocotyledons; the trunks and leaves furnish building materials; in addition to their edible fruits they yield starch, sugar and oils, as well as various useful fibers; almost all the species are ornamental, and many respond well to cultivation. In this connection it will be profitable to examine the leading subdivision of

FIG. 31.—Royal palm (*Oreodoxa regia*). After a photograph made by Mr. G. N. Collins at Rio Piedras, Porto Rico.

family, and the more important genera contained in each.

1. Subfamily Coryphoideæ. The type genus, *Corypha*, includes a number of useful palms, such as the talipot (*C. umbraculifera*) the taliera (*C. Taliera*) and the gebang (*C. gebanga*). The leaves in this group are mainly fan-shaped, and are utilized not only in the manufacture of fans, but of hats, baskets and other articles. Walking-sticks are made from the stems of the Penang lawyer, a species of *Licuala* growing in Penang. The genus *Chamaerops* includes the only palm growing in Southern Europe; it is a dwarf species, similar in general appearance to the saw palmetto of our southern pine barrens. The date palm (*Phoenix dactylifera*) is the most important tree of this tribe; its uses are too well known to require discussion. Within recent years the date has been introduced into cultivation in certain parts of Arizona, with fair prospect of success. The common Chinese fan palm of cultivation belongs to the genus *Livistona*.

2. Subfamily Borassoideae. This includes the Palmyra palm (*Borassus flabelliformis*) which is one of the sources of palm wine and palm sugar known as *jaggery*. The leaves are used for thatching, and for the manufacture of many useful articles; the fruit contains edible seeds, and its pulp is roasted and eaten. Probably no other species of palm yields a greater variety of products than this. The doum palm (*Hyphæne Thebaica*) is unique in the possession of branching stems; its fruit is a staple article of diet in Arabia. The singular fruits known as "sea-cocoanuts" are the product of a palm known as *Lodoicea Sechellarum;* it is something of a botanical curiosity, being confined to the Seychelles Islands, and is likely to become extinct in the near future.

3. Subfamily Lepidocaryoideæ. The Soutn American ita palm, *Mauritia flexuosa*, is another species affording many useful products; it furnishes a valuable fiber, and is one of the sources of jaggery. The genus *Calamus* includes a large number of species, all Asiatic, known as rattan or cane palms; some are low bushes, others climb by means of hooked spines on their leaf-stalks. Rattan is a familiar article of commerce derived from these species, while several yield a a good quality of sago or starch, and one, *C. Draco*, the drug known as dragon's blood.

4. Subfamily Ceroxyloideæ. The betel palm, Areca Catechu, and the numerous species of *Arcea* seen in cultivation afford illustrations of the beauty of palms belonging to this genus. Their long

pinnate leaves are arched in graceful curves, and they frequently attain lofty proportions. The royal palm, *Oreodoxa regia*, is common in the West Indies; the fine photograph reproduced in Figure 31 was made in Porto Rico by Mr. G. N. Collins. The conspicuous swelling of the trunk affords an easy means of recognizing this tree. The cocoanut palm (*Cocos nucifera*) is familiar to most persons; it is quite common on the Florida Keys and is employed as a shade tree in Key West (See Fig. 32). Many other genera of pinnate-leaved palms belonging to this family afford beautiful examples for cultivation. The

FIG. 32.—Cocoanut palms around a dwelling in Key West. After a photograph by Mr. G. N. Collins.

oil palm (*Elæis Guineensis*) is a native of Western Africa, and is one of the chief sources of palm oil. This group also includes the coquita palm of Chili (*Jubæa spectabilis*) and the piassata of Brazil (*Attalea funifera*).

5. Subfamily Phytelephantoideae. The principal genus of this group is the type, *Phytelephas*, native of tropical America, and put to numerous local uses by the natives.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER VI.

Order Spathiflorae. Spathe-bearing plants.

Family Araceae.—Arum family. This well known group is represented in the United States by a number of common plants, but its greatest development is in the tropics, both of the old and new world. The family contains about 105 genera and 900 species; the vast majority are coarse erect herbs, although some of the tropical forms are climbing fleshy shrubs. The root is usually either tuberous or cormose,* and contains an acrid poisonous principle; it usually abounds, however, in starch, and in certain genera yields an excellent quality of arrowroot when proper precaution is taken to extract the poisonous element. The leaves are basal, long-petioled, simple or compound, often of large size.

The flowers are usually monoecious or dioecious, at most with mere traces of perianth, and are densely crowded on a fleshy axis or spike known technically as a *spadix*. Often the staminate flowers occupy the upper and more elongated portion of the spadix, while the pistillate flowers are crowded in a globose mass below. This is well seen in the common cultivated calla lily. Overarching or completely enveloping the spadix is a large leaf-like bract known as a spathe, which is characteristic of this order of plants. In the skunk cabbage the spathe is dark purple and green, and forms an enwrapping hood or cowl. In the jack-in-the-pulpit the upper portion droops like a graceful canopy over the projecting spadix, while the lower portion is united

*A corm is a fleshy, underground stem, resembling a bulb, but solid in structure, i. e., not composed of scales. The Jack-in-the-pulpit affords a good illustration in the family under discussion.

into a cup-shaped cover for the rapidly developing green berries which later turn a brilliant scarlet. The golden-club (*Orontium aquaticum*) dispenses with the spathe as soon as its bright yellow flowers open, the former remaining only as a withered bract at the base.

FIG. 33.—The jack-in-the-pulpit (*Arisæma triphyllum*) showing hooded spathes. (From Macmillan's "Minnesota Plant Life," by courtesy of the author.)

In addition to the native aroids mentioned above there are numerous handsome tropical exotics which commonly grace our greenhouses.

Caladium is a genus in which the leaves are highly ornamental, being variegated in shades of pink, purple and green. Florists sell under this name the common lawn plant called "Elephant's-ear," which really belongs to the entirely different genus *Colocasia*, and is highly important in the tropics. It is there called *taro*, and is everywhere cultivated for the arrowroot yielded by its enormous roots. Another peculiar confusion of names is to be seen in the case of the calla of cultivation, which belongs to the genus *Aroides*. The genus *Calla*, containing a single species, *C. palustris*, is a small bog herb of the

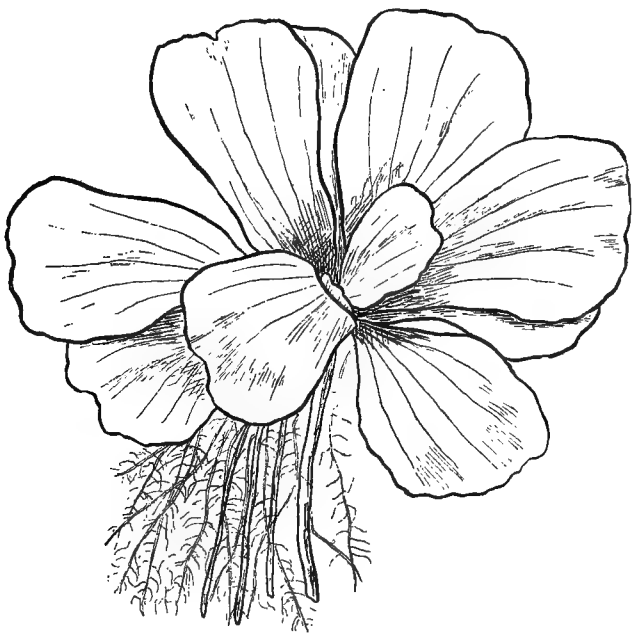


FIG. 34.—The floating arum (*Pistia spathulata*), one-half natural size. Original.

northern United States, often called water arum, and bearing only a superficial resemblance to the more pretentious plant of our window gardens. Other ornamental genera of cultivation are *Anthurium*, *Pothos*, and *Monstera*. Reference should be made to the peculiar *Pistia*, a succulent free floating plant very different from an ordinary arum, found in the streams of Florida and most tropical regions. (See Fig. 34.)

Family Lemnaceae. Duckweed Family. This group is of unusual interest, as containing the smallest known flowering plants.

They are supposed to be degenerate Aroids, and consist merely of a little disc-shaped, free-floating body, rarely exceeding one-third of an inch in diameter, and bearing on the under surface a single stamen or pistil and several minute rootlets. There are but three genera and only 25 species known throughout the world. In our stagnant pools and ditches *Spirodela polyrhiza*, the large duckweed, is often abundant, covering the surface with a carpet of green. In another genus, *Wolffia*, we find the plant body reduced to a little grain scarcely larger than a pin's head. There is a strong contrast in size, it will be seen, between the duckweed and the giant Sequoia of the Californian forest!

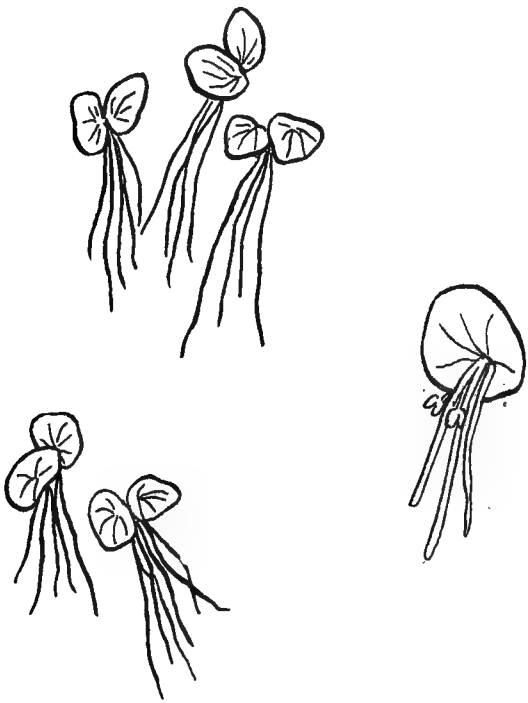


FIG. 35.—The large duckweed (*Spirodela polyrhyza*), natural size. Original.

CHAPTER VIII.

Order Farinosae.

Passing over the comparatively unimportant families Flagellariaceae, Restionaceae, and Centrolepidaceae, we come to the

Family Mayacaceae. Mayaca family. This is represented by a single genus, *Mayaca*, with seven species, one of which, *M. Aubleti*, reaches the southern United States. It is a delicate little creeping bog plant, with a habit strongly suggestive of a moss, bearing slender peduncled star-shaped flowers with a perianth composed of three sepals and three white or pink petals. (See Fig. 36.)

Family Xyridaceae. Yellow-eyed Grass family. Two genera, *Xyris* and *Abolboda*, comprising about 60 species. The plants are

tufted herbs with slender, grass-like stems, terminated by a dense spike composed of brownish scales or bracts, from the axils of which appear a few small, evanescent, bright yellow flowers. The structure of the sepals and pistal is most beautiful, but very complicated, and it can be studied advantageously only by a botanist. The stems are frequently twisted like a corkscrew, whence one of the species is called *Xyris torta*. The genus is scarcely represented in the northern states, but numerous species are scattered over the southern pine barrens.

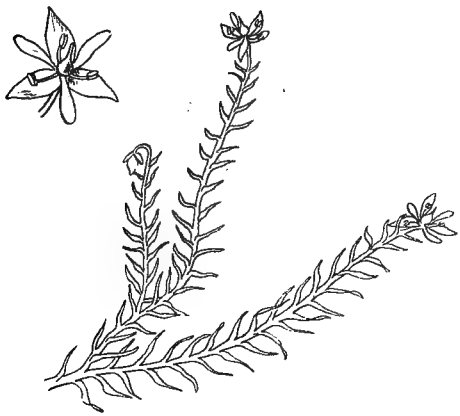


FIG. 36.—Mayaca (*Mayaca Michauxii*) showing plant of natural size, and enlarged flower. Original.

Family Eriocaulonaceae. Pipewort Family. Six genera and about 350 species, widely distributed in tropical regions, and particularly abundant in South America. Three genera reach the Southern United States, and one species of *Eriocaulon* extends even to Newfoundland. The plants grow in bogs or shallow water, and farther South usually in moist pine barrens; they are scapose, with basal grass-like leaves, and long-peduncled globose heads of very small white or greenish flowers. The perianth is in two series, forming a distinct calyx and corolla, as may be seen in the enlarged flower in Figure 38. The family possesses no economic and little ornamental value.

Family Rapateaceae. Rapatea Family. A single genus, *Rapatea*, with about 20 South American species. They are rush-like herbs, and were formerly classed with the true rushes (Juncaceae) but differ materially in certain structural characters.

Family Bromeliaceae. Pineapple Family. Everyone who has visited the southern states has noticed and admired the graceful southern moss, long moss or gray moss, as it is variously called. In Florida, too, a pineapple plantation is not an uncommon sight; and yet who would connect these two plants in any way if they had not chanced to observe the similarity of floral structure?

There is much more diversity of habit among the Bromeliaceae

than in the other families belonging to the same order. They are either epiphytes, that is, growing attached to other plants, or terrestrial; the examples just cited, of the long moss and the pineapple, illustrate both classes, In this connection the distinction between an epiphyte and a parasite should be carefully noted. An epiphyte attaches itself to another plant, usually a tree or shrub, but derives no nourishment from the tissues of its host. Such plants can be successfully grown in greenhouses upon pieces of wood, as is the case with many of our showiest orchids. A parasite, on the other hand, derives its sustenance either wholly or in part from the host to which it is attached.

FIG. 37.—Yellow-eyed grass (*Kyris torta*). Showing portion of plant and enlarged flower. Original.

FIG. 38.—Pipewort (*Eriocaulon septangulare*). Showing enlarged flower and whole plant, natural size. Original.

The Bromeliaceae contain about 35 genera and 900 species, entirely of tropical or subtropical distribution. They have fleshy, often scurfy leaves, and flowers for the most part in dense spikes or panicles. The calyx and corolla are distinct, often

of showy colors, and the inflorescence is rendered more conspicuous by the large and often brilliant floral bracts. *Tillandsia* is by far the largest genus, and the only one represented in the United States, although the long moss (*Tillandsia usneoides*) is sometimes considered, and with good reason, the type of a distinct genus. All the Tillandsias are epiphytic.

Besides the pineapple (*Ananas Ananas*) which is important as an article of diet, this family supplies several important fibre plants. Travellers to Porto Rico will probably observe the pinguin (Bromelia Pinguin) which is commonly used as a hedge plant, and yields a juice locally employed in medicine. Many other genera are in greenhouse cultivation as ornamental foliage plants.

FIG. 39.—Spanish moss (*Tillandsia usneoides*) growing on live oak at Tampa, Florida. After photograph by Mr. G. N. Collins.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER VIII. (*Continued.*)

Family Commelinaceae. Spiderwort Family. This group is almost wholly of tropical distribution; it contains 25 genera and about 350 species, *Commelina* and *Tradescantia* being the only two genera that reach the United States. The plants are herbs, frequently with long linear leaves, and with clustered flowers that open only in the sunshine and quickly wither when gathered. The flowers are subtended by leafy spathes, thus showing relationship to the Aroids; but unlike that family they have a conspicuous perianth consisting of both calyx and corolla. The stamens are often wooly with handsomely colored hairs, while the prevailing hue of the corolla is purple or blue. In *Commelina* one of the three petals is much smaller than the other two, and it is said that the author of the genus intended thus to commemorate the three brothers Commelin, two of whom were botanists, while the third had no interest in the science.

Family Pontederiaceae. Pickerel-weed Family. Every fisherman knows the pickerel-weed (*Pontederia*), which, with its wand-like spikes of blue flowers and handsome emersed cordate leaves, affords shelter for many a fine fish. The family is not a large one, containing only 5 genera and about 25 species, natives of America, Asia and Africa. In general the plants may be known by their flowers, which have a six-parted perianth, all its divisions being alike and not differentiated into calyx and corolla. The Water Hyacinth (*Piaropus crassipes*) an ornamental exotic which had proven a troublesome weed in some rivers of Florida, is also a member of this family.*

*See the article by Mr. A. H. Curtiss on the Water Hyacinth in a recent issue of The Plant World.

The Family Philydraceae is a small group consisting of a single genus and four species, natives of the Indian archipelago.

FIG. 40.—Spiderwort, Tradescantia brevicaulis.

CHAPTER IX.

Order Liliiflorae.

This large and comprehensive group may be distinguished in the main by having flowers with the six divisions of the perianth nearly uniform in color and texture. It contains eight families, some of them being among the largest of monoctyledonous groups.

Family Juncaceae. Rush Family. The rushes are limited to 7 genera, but contain over 200 species, a large part of which belong to *Juncus*. They are of very wide distribution and very varied habitat, although a majority, perhaps, may be said to prefer wet or moist ground. The plants may always be distinguished from the grasses and sedges, to which they bear a close external resemblance, by the distinct perianth, which is, however, dry and chaffy in texture. The ovary is also three-celled instead of one-celled, as in those families. Rushes have little or no economic value, even for forage purposes; but in Holland the stems of various rushes are extensively used as winter coverings for newly-planted tulip and hyacinth beds.

FIG. 41.—Dooryard rush, *Juncus tenuis*.

Family Stemonaceae. Stemona Family. This is a small group, containing one or two tropical genera and a single monotypic genus, *Croomia* in the Southern United States. More interest attaches to this plant from its extreme varity than from its appearance or structure; it is a low herb with a whorl of roundish or oblong leaves at the summit of the stems, and a few small greenish flowers. The plant has been found only in two or three localities in Florida and Alabama.

Family Melanthaceae. Bunch flower Family. This and the following three families are frequently united with the Liliaceae into one large group, but the differences of habit and floral structure are entirely sufficient to warrant their separation. The Melanthaceae contain about 36 genera and 140 species, of very widespread distribution. They have usually thick tuberous roots or rootstocks, and spicate or racemose flowers, the perianth of which is often persistent, adhering to the capsule. They are all herbs, usually scapose in habit. In our country the majority occur in the South, where the pine-barren bogs form their favorite haunts. Probably the most familiar examples of this family are the wild hillebore (*Veratrum*) and the bellwort (*Uvularia*) the latter, unlike its relatives, having solitary, nodding,

yellow flowers. In our gardens the fall crocus (*Colchicum*) is well known for its peculiar habit of blooming without leaves in the fall. The bog asphodel (*Abama Americana*) is a not uncommon plant in the New Jersey pine barrens.

FIG. 42.—Croomia.

Family Liliaceae. Lily Family. This group contains considerably over 100 genera and about 1300 species. The plants are chiefly herbs, growing from bulbs or corms, with leaves varying greatly in size and shape. The flowers are distinguished by having a conspicuous colored perianth, the divisions of which are either quite free from each other, as in the lily or tulip, or united below into a tube, as in hyacinth. The ovary is almost invariably free, that is, not coherent

with any part of the floral envelope; and it becomes in fruit a few-seeded or a many-seeded capsule. Of course there occur exceptions to these general characters, as in other large families; thus the star-

FIG. 43.—Bellflower, *Uvularia sessilifolia.*

grass (*Aletris*) has the perianth partly adnate to the ovary, while in some species of Yucca the fruit is not capsular, but fleshy and berry-like. Again, although the vast preponderance of genera consist of herbaceous plants, some of them are trees of quite imposing height.

The Lily family is noteworthy as containing a large proportion not only of our most beautiful wild flowers, but also of the various exotics which we cultivate for early blooming. Thus the little squill (*Scilla*) hangs out its blue bells with the first soft breaths of spring, and is followed in quick succession by the showy Tulips and Hyacinths, the Fritillarias and the stately Crown-imperial (*Imperialis*). In the woods at about the same season blossoms that exquisite flower which has so long staggered under the unmeaning and inaccurate name of "Dog's-tooth Violet," as if anything in the floral world could be more remote in appearance as well as structure than the lily and the true violet. The plant is sometimes, but not often, called by the quite appropriate term "Adder's Tongue," but it might be still better called what it is, namely, an Erythronium. The Lilies of the field and garden (*Lilium*), the old-fashioned Day-lilies (*Hemerocallis*) and the tall Yuccas are too well-known to need more than a passing comment. I presume that the onion, however, would scarcely be admitted as a true Liliaceous plant except by botanists. Nevertheless it belongs there, and the small flowers, when examined under a lens, are really quite lily-like in appearance.

FIG. 44.—Various species of Lilium: L. canadense; L. pardalinum; L. philadelphicum; L. superbum.

The bulbs of many of the lilyworts, as they were called by Lindley, are mucilazinous and contain medicinal properties. The well known drug syrup of squills is obtained from the South European *Scilla maritima*. The onion and its varieties, botanically known as species of *Allium*, is one of our most familiar garden vegetables. Aloes are obtained from *Aloe*, a genus extensively distributed in Africa; while the original "dragon's-blood," a drug now obtained from numerous plants, was derived from *Dracæna Draco*.

Family Convallariaceae. Lily-of-the-Valley Family. The genera of this group are 23, the species about 215, of wide distribution. These too are all herbs, and they grow without exception from root-stocks instead of bulbs. The leaves are usually broad and veiny; the perianth is variously shaped and colored. The chief distinctiue character is found in the fruit, which is a fleshy berry. A good example of this fruit may be seen on the Solomon's seal (*Polygonatum*) in mid-summer. That important succulent vegetable known as Asparagus belongs to this family, and oddly enough the little Smilax with which we decorate our tables and bouquets is also a member of the genus Asparagus. In all the species of this genus the true leaves are reduced to little scales, and the leaf-like organs which we perceive in the Smilax are called phyllodia. Thus they are functionally leaves, but structurally branchlets. The Lily-of-the-valley (*Convallaria*) and the Clintonia, both of which grow wild in the southern Alleghenies, are two exceedingly ornamental members of this family.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER IX. *Continued.*

Family Smilaceae. Smilax Family. No one who has travelled in the Middle and Southern Atlantic states can have failed to observe

Fig. 45.—The carrion-flower, *Smilax herbacea.* Original.

that pest of the Ledgerows and woods, the common greenbrier or cat brier (*Smilax rotundifolia*). This plant is the representative of a

family consisting of three genera and over 200 species, most abundant in tropical regions. It is well to explain here that the delicate little trailing plant so widely cultivated for its foliage and sold by florists under the name Smilax, is not a *Smilax* at all, but belongs to the genus *Asparagus*, of the lily family. The true Smilaxes are vines, with woody or herbaceous, often prickly stems. They have broad leaves which are an exception to the usual order of things in Monocotyledonous plants in that they are netted-veined, with several par-

FIG. 46.--The wild false hemp (*Agave sisalana*) showing habit of growth. After photograph by Mr. G. N. Collins at Sugar Loaf Key, Florida.

allel primary nerves. The petiole bears tendrils to enable the plant to climb. The flowers are small and greenish, in axillary umbels,* and are strictly dioecious. They have a regular perianth consissing of six segments, and are succeeded by globose berries. *Smilax herbacea*, (see Fig. 45) another common species of the eastern United States, is known as the carrion flower from the disgusting odor which it exhales when in bloom. The roots of several tropical species yield the drug known as sarsaparilla, while the same portions of other species are used in China for food.

*An umbel is a flower-cluster in which the pedicels or flower stalks all proceed from the same point, as in the carrot and related plants.

Family Haemodoraceae. Bloodwort Family. A small group consisting of 9 genera and 35 species, all tropical except the redroot, *Gyrotheca capitata*, a plant of the southern pine barrens. They are erect herbs with roots yielding a red juice, and small clustered flowers, the perianth 6-parted. The fruit is capsular. These plants possess interest only for the botanist, and aside from the coloring matter sometimes derived from their roots, they have no economic or ornamental value.

Family Amayllidaceae. Amaryllis Family. A large group of mostly herbaceous and usually extremely showy-flowering plants, many representative genera of which are well known in garden cultivation. There are about 70 genera and 800 species, widely distributed in warm regions. The plants are, as stated, usually herbaceous, but *Agave* and related genera have woody or even arborescent trunks. The flowers are nearly regular, the perianth divisions similar and colored alike; the stamens are 6; the ovary is 3-celled, and either wholly or partly inferior. The root is often bulbous. Only about half a dozen genera occur in the United States, and these are represented by very few species; among them is the little yellow star grass (*Hypoxis*) and the beautiful Atamasco lily (*Atamosco*) of Virginia and southward. Among familiar garden Amaryllids is *Narcissus*, with innumerable horticultural varieties; the snowdrop (*Galanthus nivalis*) the snowflake (*Leucojum vernum*) and various species of *Hippeastrum*, *Sprekelia*, *Vallota*, *Amaryllis* and *Atamosco*, all of which are sold under the composite name of Amaryllis. The well-known century plant illustrates the genus *Agave*, which is very abundantly represented throughout Mexico. It is not, of course,

FIG. 47.—Young century plants (*Agave sisalana*) developing on the flowering stalk of the parent. After Dodge, Rept. No. 9, U. S. Dept. of Agric.

true that these plants attain an age of one hundred years before producing flowers, but the development is slow, and after the plant has actually blossomed and fruited it dies outright. Figure 46 shows a species of *Agave* that grows wild on the keys of South Florida (*A. Sisalana*). Its tall, candelabra-like masses of flowers are easily discernible some distance away. The fresh leaves are used by many of the residents of the Keys in lieu of razor strops, and are considered superior to the manufactured article. Figure 47 illustrates the proliferous flower-stalks of the same species. In Mexico the

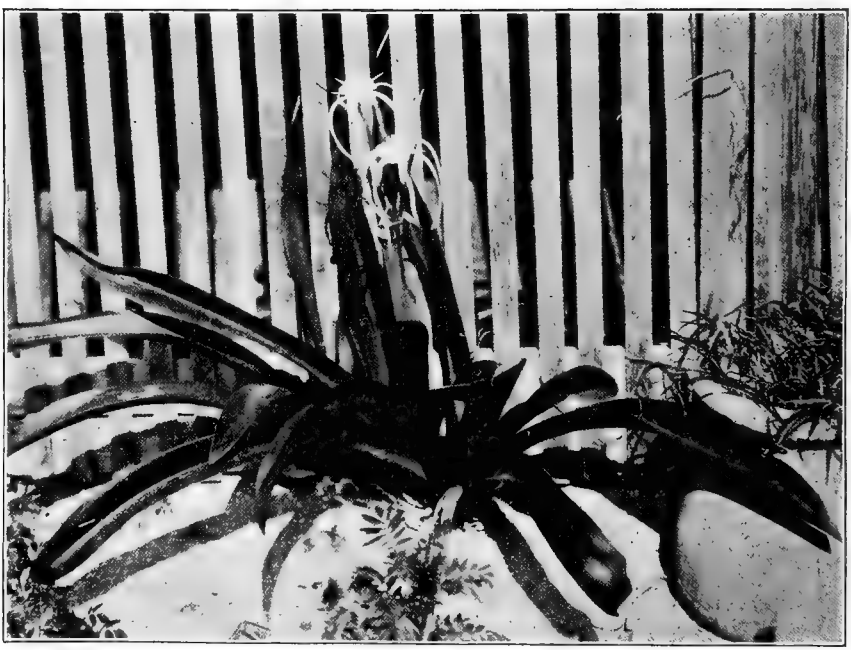


FIG. 48.—Southern Spider Lily (*Hymenocallis Caribaea*). After photograph by Mr. G. N. Collins, Upper Matecumbe Key, Florida.

agave is one of the most important economic plants. Its fermented juice, yields the native driuk pulque, while the same product distilled yields mescal. A most valuable fiber is extracted from the leaves, and the fresh juice is employed in the manufacture of soap.

Mention should be made of the peculiar appendage to the perianth, known as the *crown*, which is found in the flowers of *Narcissus* and related genera. This may be seen in the accompanying illustration (Fig. 48) of the Southern Spider Lily, a species of *Hymenocallis* growing wild on the Florida Keys.

Family Taccaceae. Tacca Family. The type and only important genus of this small family furnishes the pia plant, (*Tacca pinnatifida*) an herb extensively cultivated throughout the East Indies and Polynesia as a source of arrowroot. The plants of the family are all tropical herbs, with thick roots and basal leaves, the flowers usually small, and borne in umbellate clusters.

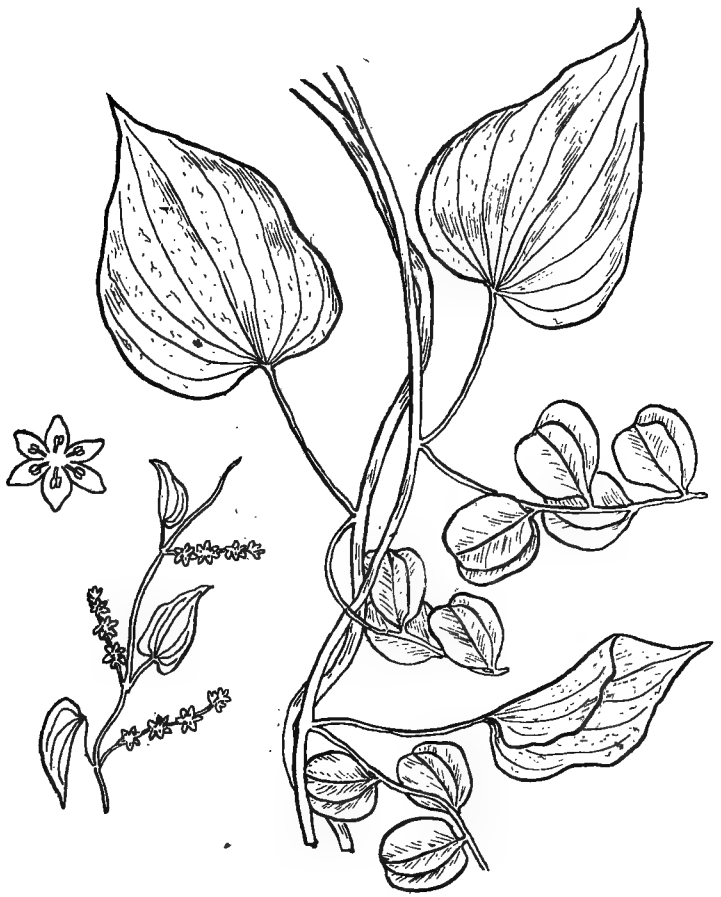


FIG. 49.—The wild yam, *Dioscorea villosa*, showing flowers and fruit. Original.

Family Dioscoreaceae. Yam family. Contains about 9 genera and nearly 200 species, chiefly natives of tropical America. They are herbaceous or woody twining vines, the leaves mostly alternate and netted-veined, the flowers dioecious or monoecious, small and inconspicuous, in axillary clusters. The fruit in *Dioscorea*, the type genus

is a 3 angled capsule, shown in the accompanying illustration of our common wild yam (See Fig. 49). In other genera, as *Tamus*, the fruit is a berry.

The large fleshy rootstocks of some tropical species fhrnish the yams of commerce. Many have the peculiar habit öf producing fleshy tubers, often called "air potatoes" in the axils of their upper leaves; these tubers sometimes attain considerable size.

FIG. 50.—Dwarf crested iris (*Iris cristata*). Original.

Family Iridaceae. Iris Family. A group of considerable size, containing about 60 genera and over 1000 species, widely distributed over the warmer parts of the globe. They shun the cold and in our temperate climate we have besides *Iris* itself only three small genera. On the other hand a great number of genera and species flourish in South Africa, and many of them are endemic there. This results in the common use among horticulturists of the term "Cape bulbs" to designate such plants as *Ixia*, *Sparaxis* and *Freesia*, all well known as pot bulbs.

The Iridaceae differ principally from their relatives, the Amaryllidaceae, in having the inner circle of stamens wanting; the flowers are frequently irregular, and the leaves are usually what is called equitant, that is, one leaf is folded over its successor and bestrides it, after the fashion of a man on horseback.

The typical genus, *Iris*, is illustrated in figure 50. The irises are much esteemed in cultivation on account of the beauty and variety of their flowers. Orris root, the basis of various different sachet perfumes, is the product of several Mediterranean species of this genus. A very different type of flower from the iris is seen in the Crocus, certain species of which are familiar to us in the garden in early spring time. In the Crocoideae the root is a corm, and the leaves are linear and not equitant. The stigmas of *Crocus sativus* yield the well-known coloring matter, saffron. Another example of a familiar ornamental genus is *Gladiolus*, the garden forms of which, after years of careful selection and hybridization, are almost innumerable.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER X.

Order Scitamineae.

We now reach a group occupying a much higher plane in the scale of development than any members of the Liliflorae. The perianth is often most irregular in shape, and the parts show a closer union; often there is a peculiar development of all but one stamen into petaloid bodies known as *staminodia*. The Scitamineae are herbs, though often arborescent in appearance, like the banana; they have usually tuberous rootstocks and large pinnately-veined leaves.

Fig. 51.—The banana, *Musa Sapientum*. (After Dodge, Rept. No. 9, U. S. Dept. of Agric.)

Family Musaceae. Banana Family. (See Fig. 51.) A family containing four genera, and about 70 species, distinguished by having flowers with five stamens. The genus *Musa* besides containing the various edible species of banana and plantain, includes one or two, as the African *M. Ensete*, which are cultivated as orna-

mental foliage plants. *Strelitzia*, another genus of this family, is known as the Bird-of-Paradise plant, from the peculiar coloring of its flowers and floral bracts.

Family Zingiberaceae. Ginger Family. About 40 genera and

FIG. 52.—Branch, flower and rootstock of West Indian arrowroot (*Maranta arundinacea*). Original.

450 species, all tropical, and particularly numerous in the forests of southern Asia. The flowers contain but one fertile stamen; the other two are united into a petaloid and often highly colored leaf, the lip or labellum. The fruit is usually a three-valved capsule. Several species

are of economic value. *Zingiber officinale*, of the East Indies, furnishes ginger; the roots of several species of *Curcuma* and *Alpinia* yield well-known drugs; and the seeds of *Eleltaria Cardamomum*, cardamon. Many species are cultivated as ornamental hot house exotics.

Family Cannaceae. Canna Family. Contains a single genus, *Canna*, with about 30 species and innumerable garden varieties. The flowers in *Canna* are very asymmetrical; there is a single fertile stamen, with a petaloid appendage, and what appear to be four showy perianth divisions, being external, narrow and inconspicuous. The Canna is one of our best known and most popular of garden plants, the wonderful improvements made by M. Crozy and other French horticulturists in the size and coloration of the flower having brought it to the front rank of garden favorites.

Family Marantaceae. Arrowroot Family. Twelve genera and about 160 species, all tropical and mostly South American. They are distinguished from the related families of this order by the stalked leaves, which have a joint-like swelling just below the blade; by the inconspicuous flowers, and by the four seeded capsule. The structure of the flower is similar to that in *Canna*, except in the form of the inner staminodia. Many species are cultivated for their handsome brightly colored foliage. The rootstock of *Maranta arundinacea* (See Fig. 52) yields arrowroot.

CHAPTER XI.

Order Microspermae.

This order, embracing the most highly differentiated types of the Monocotyledons, is characterized by the extreme irregularity of floral structure, and more complex union of parts. The name is derived from the multitude of minute seeds that are produced, only a small portion of which succeed in germinating.

Family Burmanniaceae. Burmannia Family. These interesting little plants are distributed in about ten genera and 60 species. They are tropical, with the exception of *Burmannia* and *Apteria*, which reach the southern borders of the Gulf States. The plants are small, delicate herbs, with slender, wiry stems bearing scales in place of leaves and one or more small blue or white flowers at the summit. The perianth is united into a single piece, and its tube is united with

that of the ovary, or, as it is more generally expressed, the ovary is *inferior*. The stamens are three or six, and the style is either simple or 3-cleft. In the South they may be found in rich woods, growing in moist decaying vegetable matter. Owing to the absence of leaves it was for a long time supposed that these plants were root-parasites like the broom-rapes. Figure 53 shows *Burmannia biflora* and *Apteria setacea* of natural size; the former is distinguished by having flowers with the perianth conspicuously wing-margined.

FIG. 53.—*a*, *Burmannia biflora*. *b*, *Apteria setacea*. Plants natural size. Original.

Family Orchidaceae. Orchid Family. This large and most attractive group includes the most highly specialized of the monocotyledonous plants. The carefully conducted researches of Darwin and other scientists have demonstrated that the marvelous complexity of floral structure exhibited by the orchids is the result of special adaptation or modification to secure fertilization through insect agency, and often through the visits of some particular species of insect.

Orchids are perennial herbs, with great diversity of habit. It may be stated as a general rule that those growing in temperate climates are terrestrial like most other plants, while those that are natives of warm or tropical regions are epiphytic, like the Bromeliads which were discussed in a recent chapter (see supplement, page 41). The roots of terrestrial species are usually thickened and tuberous, sometimes even bul-

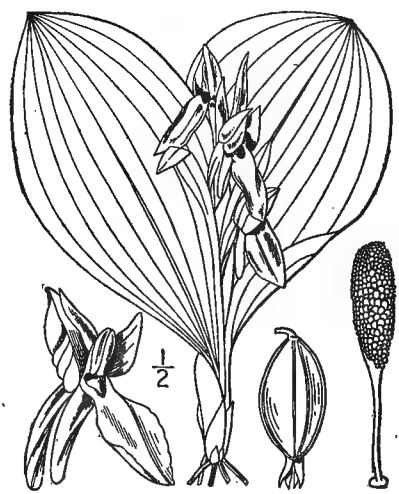


FIG. 54.—Showy Orchis (*Orchis spectabilis*) showing parts of flower. (After Britton and Brown, Ill. Fl. Northeastern U. S.

bous, while those of the epiphytes are fibrous and wiry, enabling them to become firmly attached to the support. The leaves are sheathing at base, often fleshy, occasionally reduced to scales. The flowers are very generally conspicuous and handsomely colored; even when small and of dull hues their beauty of form attracts attention.

In order to discuss floral structure in the orchids it will be necessary to explain a number of terms which are in use to indicate special modifications of the perianth, stamens and pistil. The perianth con-

FIG. 55.—The yellow lady's slipper (*Cypripedium hirsutum*) a native orchid. (From Macmillan's Minnesota Plant Life, by courtesy of the author).

sists of six parts or segments in two series of three each: the outer series or sepals are usually similar or nearly so in shape and coloration. The two lateral segments of the inner series, or petals, are also alike; but the third inner one, known as the *lip*, is widely dissimilar in shape and is often the most conspicuous part of the flower. The one or two stamens and style are entirely consolidated into a body known as the *column;* this bears one or two 2-celled anthers, the pollen of which is not of the ordinary sort, but is united by elastic threads into several stalked waxy masses called *pollinia*, attached at the base by a viscid

FIG. 56.—A group of native orchids.

disk or gland. The ovary is inferior, its tube united with that of the perianth, 3-angled, and often twisted, thus altering the natural position of the flower. These features are shown in figure 54.

The family contains 410 genera and 5000 species, of wide distribution, but most abundant in the tropics. Probably no group of flowering plants yields a larger number of species valuable for greenhouse cultivation as ornamental plants. Representatives of nearly all the important genera may be found in every large orchid house. The most economic product of the family is vanilla, which is obtained from the fruit of the climber *Vanilla planifolia* and from several related species. The common putty-root (*Aplectrum hyemale*) of the eastern United States is said to furnish a valuable cement; while the substance known as sales is derived from the roots of the European species *Orchis mascula*. The genera which are important as yielding the most beautiful flowers in cultivation are *Cypripedium*, *Cattleya*, *Laelia*, *Oncidium*, *Odontoglossum*, and *Lycaste*. With the exception of the first, these are all exotics; but some of our native Cypripediums have flowers of great beauty. Figure 55 shows a cluster of the yellow ladies'-slipper (*C. hirsutum*). Other native orchids of great beauty are *Calypso*, of the northern peat-bogs; *Limodorum* and *Pogonia*, the grass-pinks; various species of *Habenaria*, with pink, purple, orange or white flowers; and the delicate white ladies' tresses (*Gyrostachys*). The reader is referred to various popular works for more extended descriptions of our native orchids, as it is impossible to admit extended details into this brief review of the plant families. For a full discussion of the peculiar modes of fertilization no work is more valuable than Darwin's "Fertilization of Orchids," while several essays on this subject in the works of William Hamilton Gibson will be found most interesting.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XII.

General Characters of the Dicotyledons; The Orders Verticillatae and Piperales.

We have now completed a somewhat hasty review of the families belonging to the class of Monocotyledons. The reader must revert to our discussion of the differences between this group and the Dicotyledons in Chapter III, (pp. 15 and 16) of the Supplement. Dicotyledonous plants vastly outnumber those of the other class, and present such marked types of structure that it is necessary to group the numerous orders of which they are comprised in two *subclasses*, the Archichlamydeae and the Metachlamydeae. These tremendous names have a significance which will be remembered when their etymology is understood. Both are derived from the Greek language, Archichlamydeae meaning plants with a *primitive* floral envelope, and Metachlamydeae those with a *united* floral envelope. The co-ordination between these terms becomes more evident when we recollect that union of parts in floral structure indicates, in our modern understanding, a more highly advanced type. Therefore all plants like the morning-glory, the foxglove or any composite, having a corolla composed of a single piece, are considered higher in the systematic scale than plants like the buttercup, with a corolla of separate petals, or the pigweed, with no corolla at all; hence the latter examples belong to the "primitive" type of floral structure. It therefore follows that the Archichlamydeae embrace, first, all plants having flowers without any corolla (*Apetalae*), and second, all plants having flowers with a corolla of separate petals (*Polypetalae*). The Metachlamydeae comprise all plants having flowers with a corolla united in a single piece. There are, of course, excep-

FIG. 57.—*Casuarina equisetifolia*, cultivated as a shade tree in Key West. After photograph by Mr. G. N. Collins.

tions to this general rule. The union of parts other than the corolla is also considered in classification, but everything points toward a common end, and we can readily understand why the Compositae are now regarded as the very highest of the Dicotyledons, occupying a place similar to the orchids among the Monocotyledons. In the Compositae the corolla and calyx are each united into a tube; the stamens form also a tube; and lastly, the flowers themselves are aggregated into a head closely resembling a single flower, with a calyx-like cluster of bracts at its base.

The orders which we shall discuss in this and the next few succeeding chapters strongly remind one of the earlier orders in the Monocotyledons. They are mostly monoecious or dioecious plants, with no perianth and inconspicuous flowers frequently in dense clusters. The order Verticillatae comprises only a single family.

Family Casuarinaceae. Casuarina Family. A most remarkable group of trees, the systematic relationship of which has puzzled botanists for many years. The pine-like aspect, coupled with certain peculiarities in the method by which the ovule is fertilized, indicates a position close to the Gymnosperms, and it has therefore been placed by Engler and Prantl at the beginning of the dicotyledonous series. Yet the plants have still more striking points of similarity in structure to certain cryptogams, the jointed stems immediately suggesting an *Equisetum*. There is but a single genus, *Casuarina*, represented in the tropical Indo-Malayan region by about 20 species. *C. equisetifolia* is much used as a shade tree in Key West, Florida, the accompanying illustration (Fig, 57) giving an excellent idea of its lofty proportions and graceful foliage. The fruit is borne in small, woody, pine-like cones.

The order Piperales consists chiefly of herbs, with small flowers usually in close spikes; the floral envelope is wholly wanting. There are four families.

Family Saururaceae. Lizard's-tail Family. Three genera, two of which are North American, the third Asiatic; two of them contain only a single species. The plants are perennial herbs with alternate leaves; the flowers are borne in spikes, and are perfect, with from 6 to 8 stamens and an ovary of several carpels. *Saururus*, the principal genus, is a familiar object in shaded swamps, its nodding spikes of white flowers suggesting slender tassels (See Fig. 58.)

Family Piperaceae. Pepper Family. Nine genera and over 1,000 species, chiefly of tropical America; a few species of *Peperomia* occur in Florida. They are herbs or shrubs with joined stems, opposite or whorled leaves, and small spicate flowers destitute of perianth. The fruit is a sort of fleshy berry. The plants possess pungent and

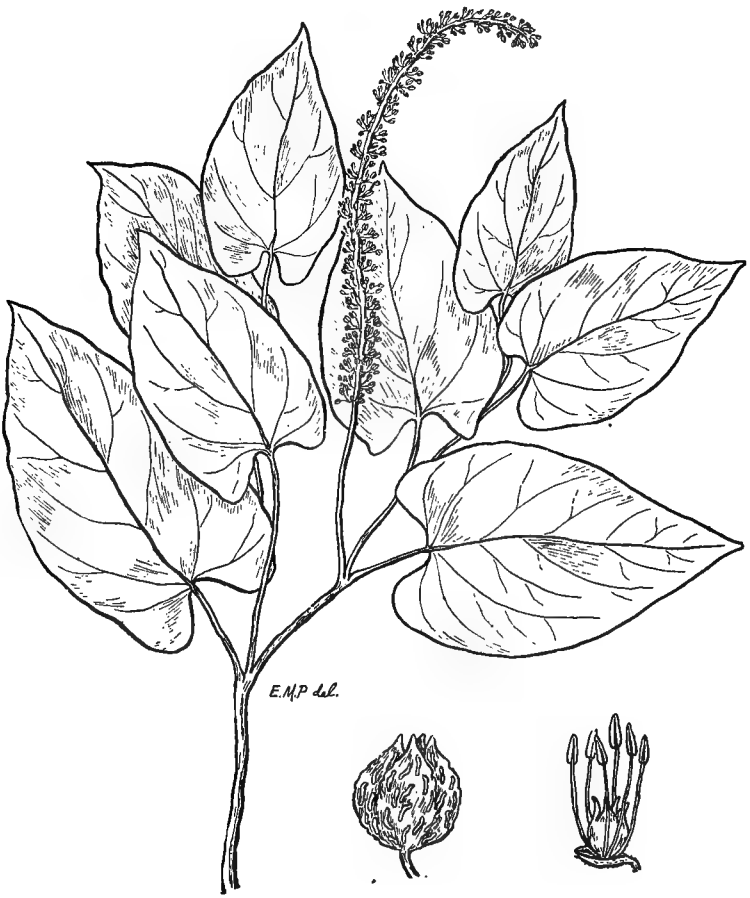


FIG. 58.—The Lizard's Tail, *Saururus cernuus*, showing detached and magnified flower and fruit. Original.

aromatic qualities which are familiar to everyone in the form of pepper, the product of *Piper nigrum*. This is a vine reaching a height of twenty or more feet; the condiment is obtained from the ripened and dried fruit. White pepper is made by divesting the fruit of its outer skin before pulverizing.

Family Chloranthaceae. Chloranthus Family. A small and unimportant group, closely allied to the Pepperworts, and consisting of three exclusively tropical genera, embracing about 30 species. They are trees, shrubs, or rarely herbs.

Family Lacistemaceae. Lacistema Family. Another small group, with a single genus, *Lacistema*, including 16 South American species.

CHAPTER XIII.

Orders Salicales, Juglandales and their Allies.

Family Salicaceae. Willow Family. This is the only example of its order, and it consists of two genera, *Salix* and *Populus*, with nearly 300 specis. Every one is familiar with the general appearance of the willows and poplars; they are all shrubs and trees, with very diverse foliage, and flowers in aments or "catkins" as they are commonly called. The plants are strictly dioecious, bearing the staminate and pistillate aments on different individuals. The seeds are invested with cottony hairs, and are produced in such abundance that on city streets where poplars are cultivated as shade trees the ground looks as if covered with driven snow during the fruiting season. The Salicaceae are natives exclusively of temperate regions, and are particularly abundant in northern bogs and swamps. The uses of various exotic species of willow for basket work are well-known, and the industry is one of large proportions. Probably no other plants afford twigs of such a high degree of flexibility, combined with toughness, as the osier willow. The severed branches are very tenacious of life, and will invariably sprout when placed in the ground, even after much exposure.

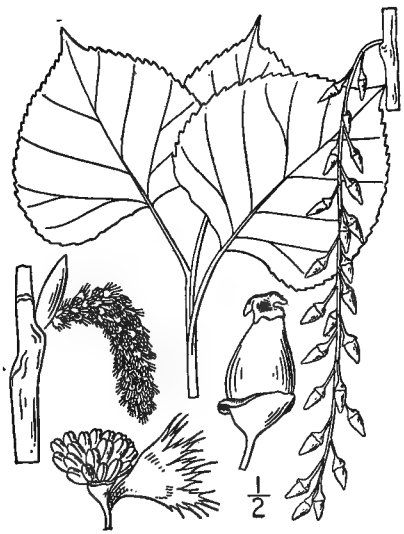


FIG. 59.—The Cottonwood or Necklace Poplar (*Populus deltoides*). After Britton and Brown, Ill. Fl. Northeast U. S.

Family Myricaceae. Sweet Gale Family. This is the sole repre-

sentative of the order Myricales, and its only genera are *Myrica*, the bayberry, sweet bay or sweet gale, and *Comptonia*, the sweet fern. Both are shrubs, the foliage delightfully aromatic, the leaves thick and coriaceous. The flowers are dioecious, without perianth, borne in aments, and are succeeded by small bony nut-like fruit, covered with a waxy resinous secretion. These berries, when gathered in quantity, furnish a most excellent wax, from which candles are occasionly manufactured. The species are not numerous, but have a wide distribution, mostly in temperate regions. (See Fig. 61.)

FIG. 60.—The Black Willow (*Salix nigra*) showing staminate and pistillate aments. Original.

The tropical family Balanopsidaceae represents another monotypic order and consists of the single genus *Balanops*. The plants are of little interest save to botanists.

Family Leitneriaceae. Leitneria Family. This family is restricted to a single rare tree of the southern United States, *Leitneria Floridana*, so peculiar in structure that it is made the type of a distinct order, Leitneriales. It occurs, so far as known, only in Florida and Missouri, and is a small tree or shrub with gray bark,

lanceolate leaves and flowers in aments, the individuals of different sexes. The ovary consists of a single carpel which ripens into a dry stone fruit or *drupe*, as it is technically called. In habitat the plants are confined to deep swamps.

Family Juglandaceae. Walnut Family. This represents another distinct order, and includes six genera, the most important being the walnut and *Hicoria*, the hickory. The walnuts number about 8 species, the hickories 15 or 20. They are natives of temperate regions, *Hicoria* being confined to North America. All are trees, with odd-pinnate leaves, and monoecious flowers, the staminate and pistillate aments being borne on the same branch. The fruit is the well-known nut of commerce. From *Juglans* we obtain the butternut, the black walnut, and the English walnut, which can be successfully cultivated in certain parts of the United States. *Hicoria* furnishes the shagbark hickory nut and the pecan.

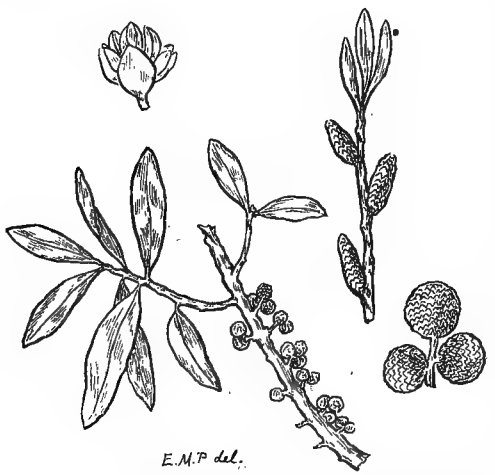


FIG. 61.—The Bayberry, *Myrica Carolinensis*. Original.

All the plants belonging to the foregoing orders are *anemophilous*, that is, they are fertilized by the agency of the wind, which blows the pollen from the staminate to the pistillate aments. There is therefore no need of a showily-colored perianth to attract insect visitors.

From Coulter's "Plant Relations." Copyright 1899, by D. [illegible]

FIG. 62.—Flowering branch of a walnut (*Juglans*). After Strasburger.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XIV.

Order Fagales.

This order is of great importance from the standpoint of economic botany and forestry, containing, as it does, a large number of the most valuable timber trees of the world. It consists of two families, both characterized by the alternate simple leaves with pronounced venation; by the monoecious flowers, born in aments as in the willows; and by the fruit, which is a one-seeded nut. The flowers have a calyx, but no corolla.

Family Betulaceae. Birch Family. Contains six genera and about 75 species, chiefly of northern distribution. They are distinguished from the related family Fagaceae by the aments, which are mostly shorter and thicker, and by the absence of a cup-shaped involucre (like that of an acorn) around the fruit. *Betula*, the birch, is undoubtedly the most important genus of this family. Birch wood is hard and durable, and being susceptible of a high polish, is frequently used in the manufacture of various articles of furniture and in house-building. The bark of the paper birch is well known for its property of peeling off in thin layers, and it is in demand for drawings and paintings. It seems to have reached the acme of utility however in the hands of the Indians, and is so strongly associated with Indian stories and legends that we can scarcely conceive of one of Cooper's dusky heroes without the accompaniment of his birch bark canoe and his tepee. Figure 63 shows an Indian encampment on the shores of a Minnesota lake; the tepees and canoes are of birch, and there is a birch forest in the background. *Betula* includes about 35 species, some of which penetrate even to the Arctic circle. *Corylus*, the hazel,

FIG. 63.—A forest of canoe birch (*Betula papyrifera*) with an Indian encampment, showing the various uses made of the birch bark. From Minnesota Botanical Studies, by courtesy of Prof. Conway Macmillan.

is a genus of shrubs, the edible nut of which is familiar to every school boy. *Carpinus*, the American hornbeam or blue beech is a handsome tree with extremely hard wood; it has a close relative in

FIG. 64.—The Black Birch (*Betula lenta*) showing ripened fertile aments and the spring-produced staminate aments. Original.

Ostrya, the hop hornbeam, which may be distinguished by the hop-like fertile aments. *Alnus*, the alder, is a characteristic swamp shrub and it is the first to expand its tassel-like staminate catkins in early spring.

Family Fagaceae. Beech Family. Contains 5 genera and about 375 species, of very wide geographic distribution. The involucral bracts around the pistillate flower in this family, ripen into a "bur" or cup, well seen in the oak and chestnut. The largest and most im-

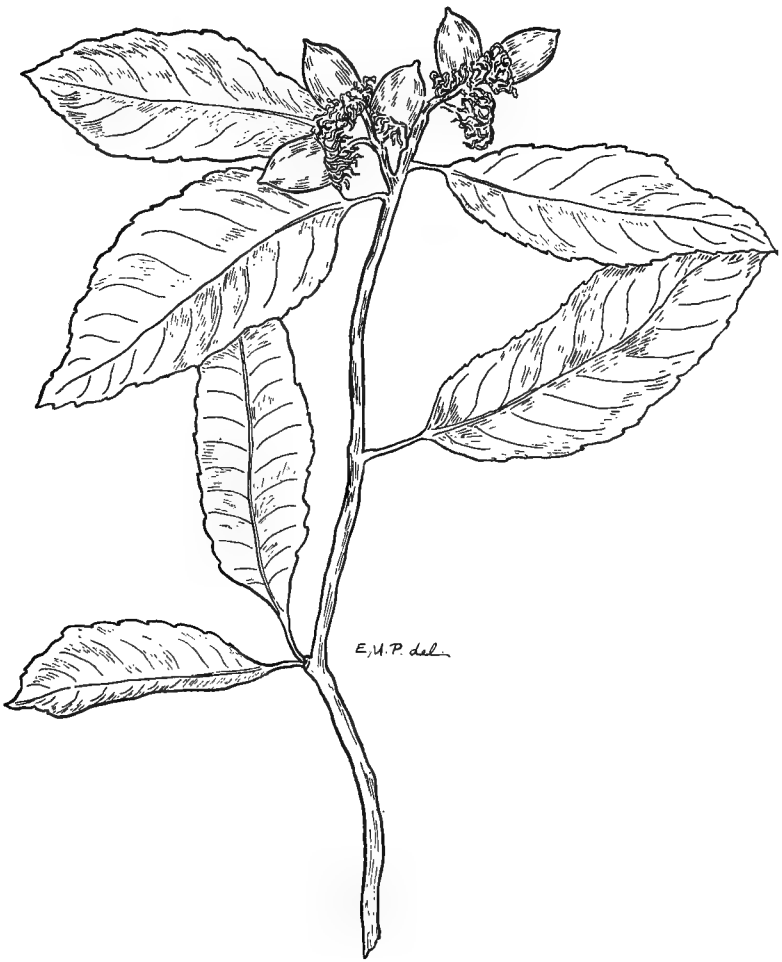


FIG. 65.—A Native Californian Oak (*Quercus densiflora*), showing fruit. Original.

portant genus is Quercus, the oak, which is represented by numerous species in North America, the mountains of Mexico and South America, and in Asia, southern Europe and Africa. Oak is probably used for a greater variety of purposes than any other wood; it is hard and very durable, and different species exhibit considerable diversity in

grain and color. Next in importance to the wood of the oak is its bark, which is very rich in tannin, and hence is employed in the manufacture of dye-stuffs and in tanning. The bark of *Quercus Suber*, a native of southern Europe, furnishes the cork of commerce. Acorns, as the fruits of the oak are commonly called, are sometimes eaten as food; they afford by their shape and size the surest method of discriminating between species that otherwise closely resemble each other. *Fagus*, the beech, is another timber tree of great beauty, and often forms extensive tracts of forest in our Eastern states and in Europe. Like *Castanea*, the chestnut, it is a small genus, comprising only four or five species. The chestnut is undoubtedly the most highly esteemed of our native nuts, being equally palatable to the squirrel and the small boy.

It will be noticed that in both Betulaceae and Fagaceae the flowers are adapted for wind rather than insect fertilization. This is true to a large extent in the families belonging to the following order.

CHAPTER XV.

Orders Urticales and Proteales.

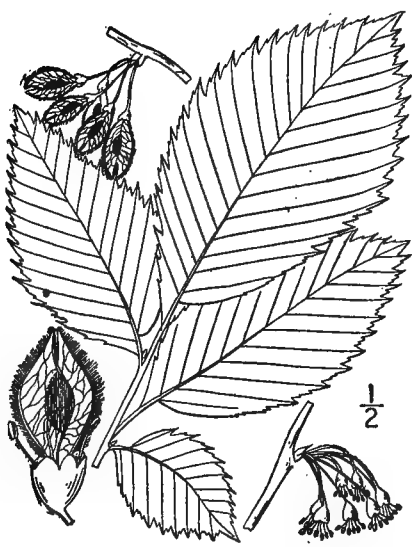


FIG. 66.—The American elm (*Ulmus Americana*) showing flowers and fruit. After Britton and Brown, Ill. Fl. Northeast U. S.

The Urticales have the flowers variously clustered, or rarely even solitary, but not borne in aments as in the Fagales. The fruit is an achene,* a drupe or stone-fruit, or a berry, never a nut. The order consists of three families—Ulmaceae, Moraceae and Urticaceae. The order Proteales, which is confined to the southern hemisphere, is restricted to the single family Proteaceae.

Family Ulmaceae. Elm Family. Contains about 13 genera and 140 species, of wide distribution in both temperate and tropical regions. *Ulmus*, the elm, is noted

*Achene is a name given to a small dry one-seeded fruit that does not split open (indehiscent) when ripe.

more for its beauty as a shade tree than for its value as lumber; the mucilaginous inner bark of the slippery elm (*Ulmus fulva*) is a well-known officinal product. All the Ulmaceae are trees or shrubs, with

FIG. 67.—A tropical species of Fig (*Ficus arbutifolia*) shading a house in Porto Rico. After photograph by Mr. G. N. Collins.

small clustered monoecious or dioecious flowers having a perianth of several distinct or united sepals. The fruit is variable, being in Ulmus

dry and winged (called a samara) and in other genera either a drupe (stone-fruit) or nut.

Family Moraceae. Mulberry Family. Contains about 55 genera and nearly 1000 species, natives largely of tropical regions. 600 species belong to the single genus *Ficus*, the fig, which is of immense economic importance, as it is the chief source of caoutchouc and furnishes us also with delicious fruits. Strictly speaking, the part which is eaten is not the fruit, but the pulpy receptacle, in which are embedded the numerous small dry achenes commonly known as seeds. A similar condition exists in *Morus*, the mulberry; the claims of this tree to economic consideration lie chiefly in the fact that it is the best food for silkworms. The Moraceae are distinguished from the preceding family by the structure of their fruit, and by the presence of a milky sap. Among the genera of interest may be mentioned *Artocarpus*, the breadfruit, which is an important item in the dietary of the natives where it grows; *Brosimum*, the "cow-tree" of Venezuela, the sap of which furnishes a pleasant drink; *Humulus*, the common hop; *Broussonetia*, the paper mulberry, an ornamental tree which has become naturalized in the eastern United States; and *Cannabis*, the hemp.

FIG. 68.—The Hemp Plant, *Cannabis sativa*. After Dodge, Rept. No. 9, U. S. Dept. of Agric.

Family Urticaceae. Nettle Family. Contains about 40 genera and nearly 500 species, very widely distributed. The majority are herbs, many of them provided with painfully stinging hairs. The sap is watery, and not of milky consistency, while the fruit is an achene.

The two preceding families were formerly united with the true nettles in a single family, but under the modern conception of natural affinities are considered as distinct groups.

Some of the plants in this family have strong bast fiber which may be utilized like hemp, but aside from this they are of no economic value, and many are troublesome weeds. Familiar examples of the latter are the various true nettles (*Urtica*); the wood nettle (*Urticastrum*); and the richweed or clearweed (*Adicea*).

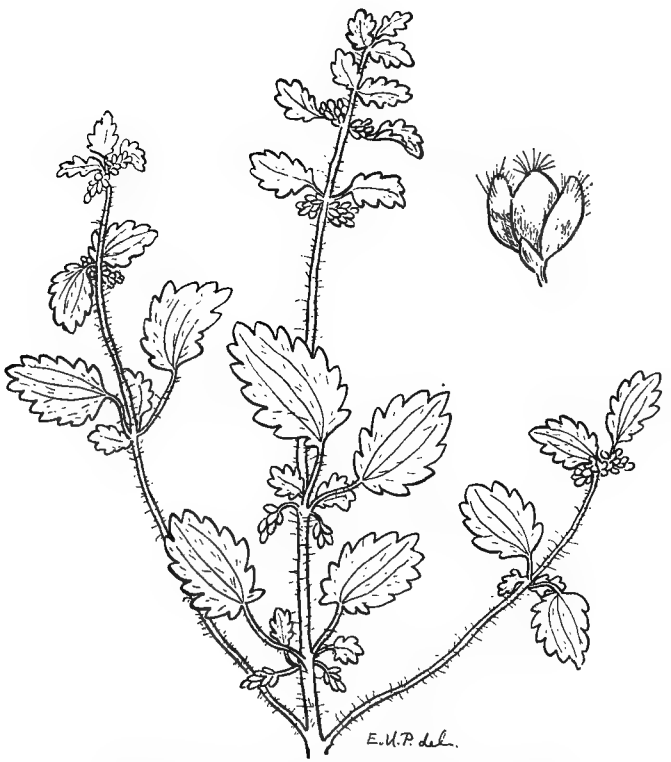


FIG. 69.—The Stinging Nettle (*Urtica urens*). Original.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XV.—*Continued.*

Family Proteaceae. Protead Family. A very large family, comprising about 50 genera and nearly 1000 species, many of which are

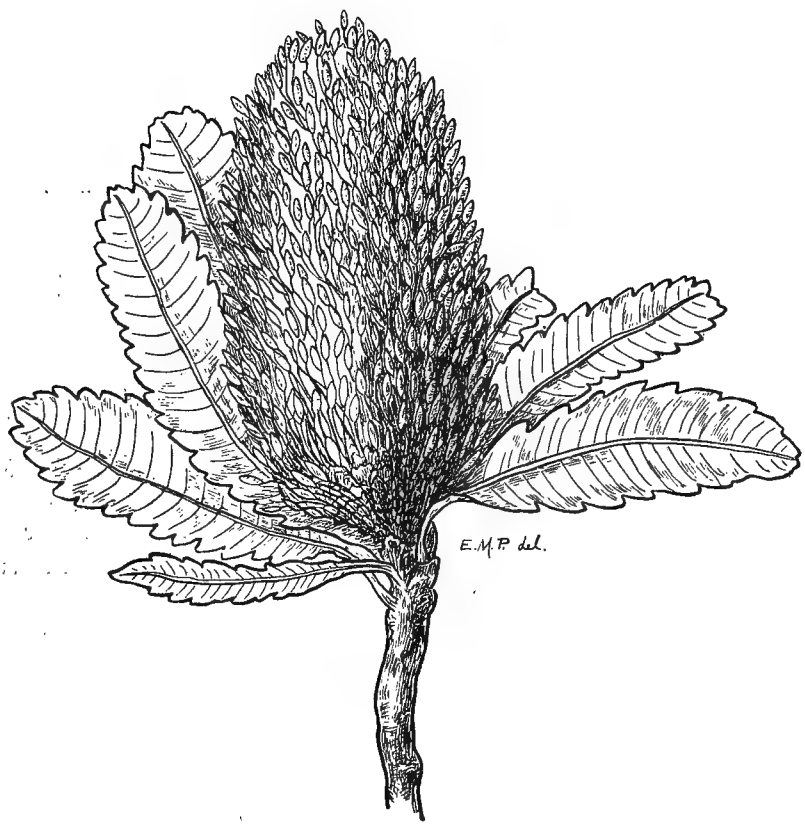


FIG. 70.—Flower-head of an Australian species of *Banksia*, a genus belonging to the Proteaceae; one-half natural size. Original.

peculiar to Australia and South Africa. They are trees or shrubs with a most remarkable diversity of habit and inflorescence. The perianth is 4-parted, consisting only of calyx; the stamens are also four, placed opposite the divisions of the perianth; and the ovary is superior and one-celled. The plants have no medicinal properties, but are cultivated for their peculiar flowers, which are frequently borne in dense cone-like clusters, and are often beautifully colored. (See Fig. 70.)

CHAPTER XVI.

Order Santalales.

The Santalales are a group of plants with very varied habit. They are herbs, shrubs or trees, largely tropical, but represented by several genera and species in temperate climates. Many of the plants are parasitic on the wood of trees to which they are attached; others are terrestrial, but derive their sustenance from the roots of other plants. In general the Santalales are distinguished by the more or less inferior ovary, the calyx being partially or wholly united with it. The ovary contains a single cell.

Family Loranthaceae. Mistletoe Family. Contains about 21 genera and 500 species of wide geographical distribution, but most abundant in the tropics.

They are parasitic herbs or shrubs, green or yellowish-green in color, as they contain chlorophyll and elaborate in their own tissues the food materials extracted from the host plant through specialized roots known as *haustoria*. The leaves and stems are fleshy or waxy in texture and the flowers are inconspicuous, having usually only a calyx but in some cases both calyx and corolla. The calyx is more or less adherent to the ovary, which becomes a one-seeded berry in fruit. The stamens are 2 to 6 in number.

The American mistletoe (*Phoradendron flavescens*) is the most familiar native representative of the family. There are other species of *Phoradendron* occurring in the far West, and the related genus *Razoumofskya* is found in the same region. In tropical countries there are numerous species of *Loranthus*. The European mistletoe, represented in Figure 71, belongs to a distinct genus, *Viscum*, and is more

highly prized at Yuletide than the American variety, as its berries are much larger, and of a pearly white color.

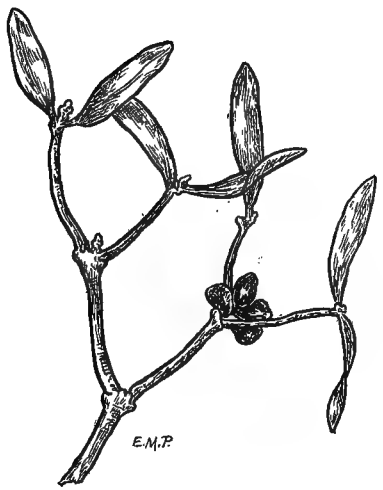


FIG. 71.—The European mistletoe (*Viscum album*) one-half natural size. Original.

The host-plants of the mistletoes are quite varied in character. Some species confine themselves to a single variety of shrub or tree; thus one is found on the southwestern juniper (*Juniperus pachyphloea*). Others, like the common Phoradendron, are not at all partial, growing on sour gums, maples or even oaks.

This family has no economic use, although a kind of bird lime is sometimes prepared from the berries of European species.

Family Myzodendraceae. Another group of parasitic plants closely allied to the Loranthaceae, and consisting of about 10 South American species.

Family Santalaceae. Sandalwood Family. Contains about 26 genera and 250 species, mainly tropical. They are herbs, shrubs or occasionally trees, frequently half-parasitic on the roots of other plants, but not growing wholly exposed like the Loranthaceae. The flowers, which are variously clustered, have only a calyx; they are monoecious, dioecious or perfect. The stamens are 3 to 6, inserted opposite the calyx-lobes. The ovary is inferior and one-celled as in the Loranthaceae; but it becomes in fruit a drupe (stone-fruit) or nut.

In this country we have several familiar herbs of the genus *Comandra*, and known as bastard toad-flax, which belong to this family. They have ter-

FIG. 72.—The Pale Bastard Toad-flax (*Comandra pallida*), one-third natural size. Original.

minal clusters of small greenish-white flowers and may be found growing in open underbrush. In the southern states three rare shrubs, *Darbya*, *Pyrularia* and *Buckleya* also represent the family. In Europe the genera and species are much more numerous; while in Asia the family becomes important on account of the Sandalwood, derived from various species of *Santalum*.

Family Grubbiaceae. Grubbia Family. A small and insignificant group consisting of the single genus *Grubbia*, with 3 South African species.

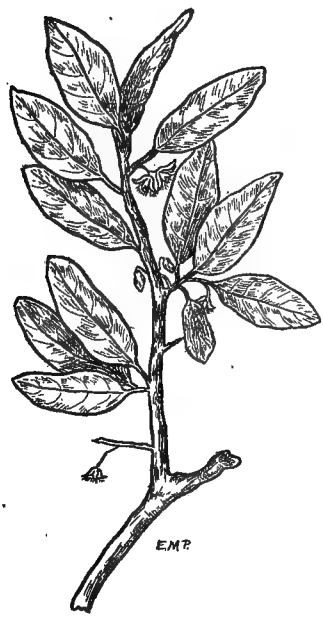


FIG. 73.—The Florida Wild Plum (*Ximenia Americana*), one-half natural size. Original.

Family Opiliaceae. Opilia Family. Consists of three or four genera, each with one or two species, confined to the tropics of the Old World. By many botanists it is regarded as a section of the following:

Family Olacaceae. Olax Family. A group containing about 20 genera and 115 species, natives exclusively of tropical and subtropical regions. They are trees or shrubs with simple alternate leaves, and perfect flowers provided with both calyx and corolla; the former is united into a single piece (*gamosepalous*), and the corolla consists of 3 to 6 distinct petals; fertile stamens 3 to 10, with a like number of sterile filaments; ovary several-celled, becoming a one-seeded, fleshy fruit.

The genus *Ximenia*, represented by a single species in Florida, *X. Americana*, brings this family within the flora of the United States. Figure 73 shows a branch with flowers, in which may be seen the sterile filaments. The fruit is yellow and so much resembles a plum in appearance that it is locally called by that name. It is edible, being sweetish in taste and slightly astringent in properties.

Family Balanophoraceae. Balanophora Family. Contains 14 genera and about 30 species, natives of warm or hot climates. They are succulent leafless parasites, entirely destitute of chlorophyll, and consequently not green in color, but of various shades of yellow or

red. The flowers are subtended by scales or bracts, and are unisexual and monoecious, the staminate and pistillate occurring on the same plant. There is usually a small perianth consisting of a single series (calyx), but even this is sometimes wanting. Some of these plants are much sought on account of their supposed medicinal virtues; this is particularly true of *Cynomorium coccineum*, a south European plant which on the Island of Malta was formerly carefully guarded, and its growth and gathering supervised by a person specially appointed to that office under the English government. Various species of *Balanophora* furnish a sort of wax which is used by the natives of Java for making candles.

CHAPTER XVII.

Orders Aristolochiales and Polygonales.

The order Aristolochiales includes three families. The group is distinguished by the perianth, which although strictly a calyx, is very

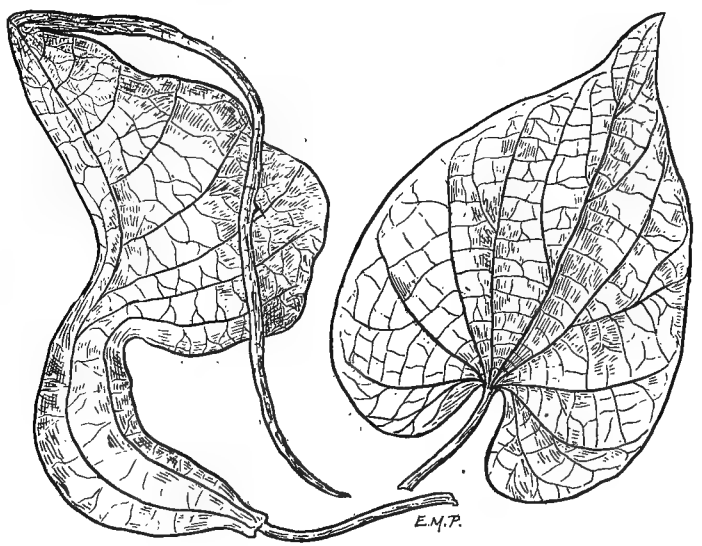


FIG. 74.—The Goose-flower (*Aristolochia fœtens*) and leaf; both one-half natural size. Original.

often showily colored like a corolla; it is either cup-shaped and regular or tubular and very irregular in shape. The ovary is inferior, and several-celled instead of one-celled as in the Santalales.

Family Aristolochiaceae. Birthwort Family. Contains 5 genera and about 200 species, of which 180 belong to *Aristolochia* alone. The family may be known by the tubular calyx, more or less inflated below, and adherent to the ovary at the base. The stamens are six, adherent to the style (columnar portion of the pistil), while the fruit is a many-seeded, 6-celled capsule. The plants are herbs or climbing shrubs, with wood of most remarkable structure and quite distinct from that of all other exogens, consisting of radiating plates of wood not disposed in rings. They are mostly of tropical distribution, being particularly abundant in South America. The flowers of *Aristolochia* are very diverse in shape and coloring; many species of this genus are ornamental in cultivation, as for example the familiar "Dutchman's pipe." (*A. macrophylla*) and the tropical species sold as "gooseflower" (*A. fœtens*) a flower and leaf of which, one-half the natural size, are shown in Figure 74. The genus *Asarum* is well represented in the Eastern United States, *A. Canadense* being the wild ginger or asarabacca. The species of *Asarum* are all stemless herbs with handsome, often mottled, coriaceous leaves, and odd-looking flowers borne at the surface of the ground.

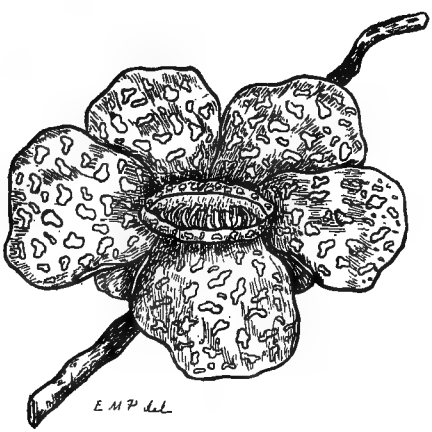


FIG. 75.—Parasitic flower of *Rafflesia Arnoldi*, very much reduced. Original.

These plants have very well-known medicinal properties; the roots are highly aromatic, and furnish a stimulant and a specific against snake poison; some species yield purgatives and vermifuges as well. The chief point of interest attaching to the group lies in the unaccountably close affinity to the Monocotyledons, as shown by the six stamens and six-celled capsule, and by the peculiar structure of the wood to which reference has been made above.

Family Rafflesiaceae. Rafflesia Family. This truly remarkable family has a world-wide reputation as the best illustration of vegetable parasitism carried to the farthest possible extent. There are 7 genera and about 20 species, all of which are reduced to mere flowers

which develop from buds parasitic on various trees and shrubs. The stem and leaves are wholly wanting; the whole plant consists of a single flower, often of gigantic size, which gradually develops, ripens its seed and perishes. By far the most celebrated genus is *Rafflesia*, containing about 6 species, natives of Java, Sumatra, Borneo and the Philippine Islands. They grow exclusively on various species of *Cissus*, a genus allied to our grapes. Figure 75 gives a good idea of the general appearance of the flower, the species being *R. Arnoldi*, the original type of the genus.

The flowers have a 5-cleft calyx, usually globular or cup-shaped, sometimes saucer-shaped, with numerous stamens borne on a central column. Some species of *Rafflesia* have flowers of gigantic size, measuring several feet in diameter; the buds resemble huge cabbages. They are usually foul smelling and decay easily.

Family Hydnoraceae. Hydnora Family. A group of fungus-like fleshy parasites consisting of two genera and about 8 species, natives of South Africa.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XVII.

Orders Polygonales and Centrospermae.

The order Polygonales comprises the single family Polygonaceae, and its characters are those of the family. The Centrospermae, on the other hand, form a group of considerable size, embracing no less than ten families, of more or less economic or ornamental interest. This order is distinguished from the Polygonales by the variously curved or coiled embryo* in the seed, and by the fruit, which is not an achene. The flowers are mostly perfect, rarely monoecious or dioecious, and the ovary is entirely superior or free from the calyx in both groups.

Family Polygonaceae. Buckwheat family. Contains about 30 genera and 800 species, of very wide geographic distribution. They are herbs, frequently of twining habit, shrubs or even trees, their most conspicuous feature being the sheathing united stipules around the bases of the leaves. This sheath is so distinct in appearance from the ordinary type of stipule, that it is known by a special name, ocrea. The leaves are simple, mostly entire; the flowers are small and regular, variously clustered, with a perianth consisting of calyx alone, which, however, is frequently colored like a corolla. The stamens are 2 to 9 in number, the ovary 1-celled, becoming in fruit a shining angled or lenticular (prune-shaped) achene.

The Polygonaceae are well represented in our country, not only by numerous species of smartweed (*Polygonum*) and of dock (*Rumex*), but in the western States by many species of the genus *Eriogonum*, which may be known by the umbelled or capitate flower-clusters, each group springing from a bell-shaped or cup-like involucre. *Polygonum* is the largest genus of the family, however, and has also the widest distribution, being found from the far north all the way to the tropics, the species usually of rank growth and weedy appearance.

Buckwheat, an important article in the daily dietary of many per-

*This can be seen very plainly by cross-sectioning the seeds of some one of the common goosefoots (*Chenopodium*).

sons, is the product of *Fagopyrum Fagopyrum*, a member of this family, illustrated in Fig. 76. The plant, originally a native of Asia, is grown extensively in some parts of the United States and on the continent of Europe, whence it has escaped frequently and become established in a half-wild state. Buckwheat flour, although less nutritious than wheat, is greatly superior in this respect to rice. Another polygonaceous food-plant of considerable importance is the rhubarb (*Rheum Rhaponticum*). As we are familiar with it in gardens, it is a tall herb with enormous basal leaves, whose thick juicy stems furnish a most appetizing sauce, and filling for pies. Like *Rumex*, it contains a very powerful acid principle, upon which its value as an article of food chiefly depends. The genus *Rheum* is native of eastern Europe and Asia, several of the species being described by travelers as very imposing features of the landscape, particularly in dry waste regions of the Himalayas.

Fig. 76. Flowering branch of buckwheat (*Fagopyrum Fagopyrum*), with enlarged flower and fruit. Original.

There are several ornamental plants of the family, the most familiar in greenhouses being the vine *Antigonon leptopus*, the large inflated calyces of which are bright red in color, and retain their beauty on the plant for some time. *Brunnichia*, a native shrubby vine of the southern States is also worthy of cultivation, although the flowers are not brilliantly colored. The prince's feather (*Polygonum orientale*) is a favorite in gardens.

Family Chenopodiaceae. Goosefoot Family. Contains about 75 genera and 550 species, of wide geographic distribution. The goosefoots, or pigweeds, as they are often called, are herbs or rarely shrubs, having simple leaves entirely without stipules. The flowers are perfect or bisexual, usually greenish in color, variously clustered. The perianth consists only of a calyx, which is persistent, investing the fruit. The latter is known as a utricle, being a grain with several enveloping papery coatings. The two uppermost drawings in Fig. 77 will

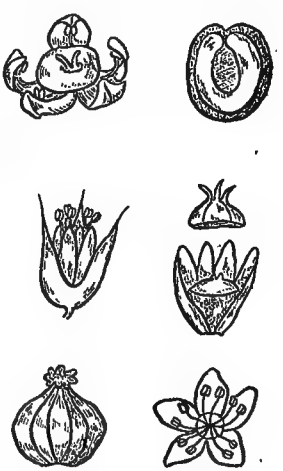


Fig. 77. Uppermost line, enlarged flower and section of fruit of *Chenopodium*; second line, flower and fruit of *Amaranthus*, showing the circumscissile utricle; lowermost line, flower and fruit of *Phytolacca*. Original.

give a good idea of the floral structure in this family, and of the curved embryo shown in the cross-section of the fruit.

With the exception of *Chenopodium*, the species of which are mostly distributed over the country as weeds, the American Chenopodiaceae are largely natives of the western States, where they form the predominant vegetation of the so-called "alkali" plains, and are known as saltbushes (*Atriplex* and *Suaeda*). Farther south one meets the shrubs known as "greasewoods" (*Sarcobatus*), which are abundant in the desert regions of the lower Colorado watershed. When growing in saline soils, either in the interior, or along the coast, the plants are usually extremely fleshy and succulent, like other halophytes. (See Fig. 78.)

As potherbs many of the members of this family are highly esteemed. The leaves of spinach (*Spinacia*), of the beet (*Beta*), and of the common lamb's quarters (*Chenopodium album*) are used for this purpose. The beet, moreover, is of commercial importance, aside from its value as a vegetable, on account of the sugar extracted from it. The sugar-beet industry, particularly in France, has assumed large proportions in recent years, and the product is in many respects superior to cane sugar. Soda and potash are obtained from some species of *Salsola*, while many of the genera yield essential oils valuable in medicine as antispasmodics.

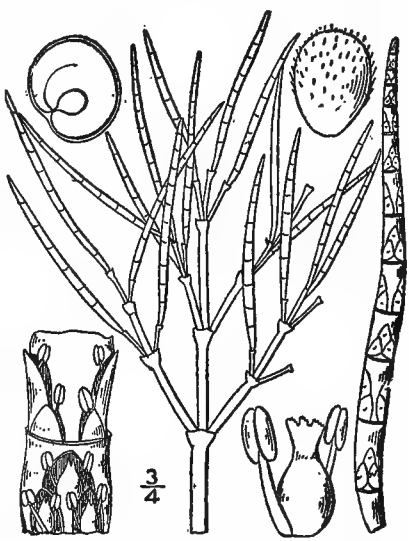


Fig. 78. The common saltwort (*Salicornia herbacea*), showing the fleshy cylindrical leaf. After Britton & Brown, Ill. Fl. Northeast. U. S.

Family Amaranthaceae. Amaranth family. Contains about 40 genera and 450 species, widely distributed, but most abundant in the tropics. They are herbs or undershrubs, with simple leaves and small perfect monoecious or dioecious flowers, usually borne in dense clusters. The perianth may be in one or two series, but there are no true petals. Like other families in the order Centrospermae, the Amaranth fruit is utricular, but it splits in a transverse ring at about the middle; this is called by botanists a circumscissile dehiscence. The flower and fruit are shown in the middle line of Fig. 77.

The genus *Amaranthus*, which shares with *Chenopodium* the name of "pig-weed," is one of the largest representatives of the family, and includes a number of familiar weeds of the eastern United States. The

flower-clusters in some species are bright red, and these types are cultivated in gardens, together with *Celosia*, the cockscomb, and *Gomphrena*, the globe amaranth.

Family Nyctaginaceae. Four-o-clock Family. Contains about 17 genera and 250 species of wide distribution, most of them American. They are herbs, shrubs or trees, with simple entire leaves, and perfect clustered flowers, often subtended by an involucre simulating a calyx, the latter in its turn usually colored like a corolla, which is always wanting. The sepals are united, and the calyx is thus called gamosepalous. The ovary is one celled, becoming a grooved or winged fruit.

Fig. 79. The pink Abronia (*Abronia micrantha*) showing flowers and wing-margined fruit. Original.

Probably the most familiar example of this family is the common four-o-clock or marvel-of-Peru (*Mirabilis Jalapa*). The flower has a funnel-shaped calyx of various colors, exactly imitating a corolla, while the green involucral bracts at the base of the calyx tube are usually taken by the student for a true calyx. *Mirabilis* is represented by several species in the southwestern States. *Abronia*, also a western genus, is commonly cultivated for its verbena-like clusters of variously colored flowers. (See Fig, 79.

Family Batidaceae. Batis Family. This consists of a single genus and species, *Batis maritima*, a fleshy maritime shrub of the West Indies and the Gulf coast.

Family Cynocrambaceae. Cynocrambe Family. Likewise restricted to a single type, *Cynocrambe prostrata*, a low shrub native of the Mediterranean region.

Family Phytolaccaceae. Pokeweed Family. Contains about 22 genera and 90 species, mainly tropical. They are herbs or shrubs, with entire leaves destitute of stipules, and regular, polygamous or monoecious flowers, the perianth consisting of calyx alone; the structure of the flower may be seen in the lowermost drawings of Fig. 77. The fruit is either berry-like or capsular. The ovary contains several cells.

Most of the pokeweeds possess bitter emetic or purgative properties, and some are violent poisons. On the other hand, the herbage of

our common North American representative of the family (*Phytolacca decandra*), furnish a most palatable dish when the young shoots are boiled like Asparagus. The berries yield a dark red dye.

Fig. 80. The carpetweed (*Mollugo verticillata*) showing enlarged flower and section of fruit. After Britton & Brown, Ill. Fl. Northeast. U. S.

Family Aizoaceae. Carpetweed Family. Consists of 22 genera and about 500 species, natives chiefly of warm regions. They are nearly all herbs of insignificant aspect, usually prostrate and diffusely branched, with opposite or whorled leaves and small perfect flowers, mostly destitute of petals. The ovary is free from the calyx and several-celled, becoming a capsule in fruit. The common carpetweed (*Mollugo verticillata*) is shown in Fig. 80. *Sesuvium Portulacastrum*, the sea purslane, is a familiar plant along the southern seacoast. By far the largest genus is *Mesembryanthemum*, various species of which are cultivated in gardens, *M. crystallinum* being the well known "ice plant." It is a curious feature of distribution that two species of this genus occur on the islands off the coast of California, while the remainder are confined almost exclusively to the Old World. The family is also known by the name Ficoideae.

Fig. 81. *Lewisia rediviva*, a plant of the Family Portulacaceae, nearly natural size. Original.

Family Portulacaceae. Portulaca Family. Contains about 20 genera and 175 species, largely American, and always showing an affinity for dry and arid regions, their succulent and fleshy herbage enabling them to withstand any amount of drought. They are

closely related to the Pink family (Caryophyllaceae) but differ in the calyx, which consists commonly of only two sepals. The petals are frequently large and showy, but always evanescent; they are four or five in number, and like the stamens are hypogynous, that is, they are inserted on the axis beneath the pistil. The ovary is 1-celled, becoming in fruit a capsule which opens either by three valves, or is circumscissile (see above).

Our familiar garden representative of this family is the portulaca (*Portulaca* sp.), which is remarkable for the brilliancy and variety of coloration displayed by its flowers. The common purslane or "pusley" is also a species of *Portulaca*, though scarcely so highly esteemed. *Claytonia*, the spring beauty, is one of the daintiest of our wild flowers in the eastern States; in the west the species are much more numercus, although none of them surpass *C. Virginica* in beauty. *Lewisia*, a genus of the western plains, has large pink flowers and very fleshy leaves. An entire plant, only slightly reduced, is shown in Fig. 81.

Family Basellaceae. Basella Family. Six genera and about 16 species, mostly tropical American fleshy twining vines. They have been frequently united with the Chenopodiaceae, but differ in the position of the stamens and in the bracts around the base of the calyx. *Boussingaultia*, the Madeira-vine, is common in cultivation.

Fig. 82. The white campion (*Silene alba*), the detached calyx natural size. Original.

Fig. 83. Long-leaved stitchwort (*Alsine longifolia*), with enlarged flower. Original.

Family Caryophyllaceae. Pink Family. Contains about 70 genera and over 1500 species, widely distributed, but most abundant in the northern hemisphere. They are all herbaceous plants, the stems frequently swollen at the joints, the leaves opposite and with or without stipules. The flowers are perfect, provided with both calyx and corolla, the former either composed of distinct sepals or united into a tube. The ovary is one-celled, becoming a utricle or capsule in fruit. Owing to the fact that a uumber of genera of very diverse habit and structure are included in this family, it is difficult to give more than very general characters.

The Caryophyllaceae are of interest only as ornamental plants. Various species of *Dianthus* are represented in cultivation by innumerable horticultural varieties, including all the pinks, picotees, carnations, etc. *Lychnis, Silene* and *Gypsophila* are also cultivated. In Fig. 82, a wild white-flowered species of the latter genus (*Silene alba*) is shown. A number of small herbs with white or greenish flowers, known collectively as "chickweeds," are comprised in the genera *Arenaria, Alsine, Spergula, Tissa* and *Cerastium*. These are all distinguished from the true pinks by having the sepals distinct and not united into a tube. (See Fig. 83.) One of the familiar weeds of waste places is the "Bouncing Bet," *Saponaria officinalis*, also a member of the Pink Family.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XVIII.

Order Ranales.

The representatives of this order include many of our most familiar native plants, and some of them are among the first to appear in early spring. The order is a large one, comprising sixteen families, of which the Nymphaeaceae, Ranunculaceae, Berberidaceae, Magnoliaceae and Lauraceae are the most important. As a rule, the flowers have a corolla composed of distinct petals, but there are often cases of apetalous flowers, particularly in many Ranunculaceae and in practically all the Lauraceae. The ovary is always superior and free from the calyx; it may be composed of one or many carpels. The stamens are numerous and hypogynous (inserted beneath the ovary).

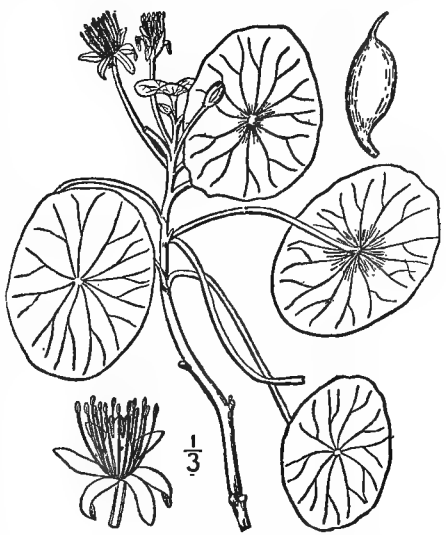


Fig. 84. The water-shield (*Brasenia purpurea*). After Britton & Brown, Ill. Fl. North. U. S.

Family Nymphaeaceae. Water-lily Family. Contains eight genera and about 30 species, all aquatic herbs, denizens of fresh water ponds and streams in temperate and tropical regions. They furnish by far the finest and most ornamental examples of cultivated aquatics. The plants produce solitary axillary flowers, whose structure differs remarkably among the different genera. In the water-shields (*Cabomba* and *Brasenia*) the sepals and petals are 3 and the stamens 6; in the true water-lilies (*Castalia*), the lotuses (*Nelumbo*), and the spatter-dock (*Nymphaea*), the petals and stamens are numerous, and there is often a tendency for the stamens to become petaloid and to lose their function as pollen-bearers.

All the transition stages of this process may be observed in the flower of the common water-lily. This genus (*Castalia*) is represented in the United States by several species. The flowers of *C. odorata* are the most fragrant; in southern species the fragrance partially or wholly disappears. On the coast of New England, particularly on Cape Cod, occurs a beautiful pink-flowered variety. The exotic Castalias, usually cultivated as Nymphaeas, exhibit a wide diversity of coloration, including all shades of blue, purple and red. The yellow lotus (*Nelumbo lutea*) is common in certain parts of the country, while the pink lotus (*N. Nelumbo*) has become naturalized in ponds about Bordentown, New Jersey. The giant water-lily of the Amazon (*Victoria regia*) is too well known by description to require comment.

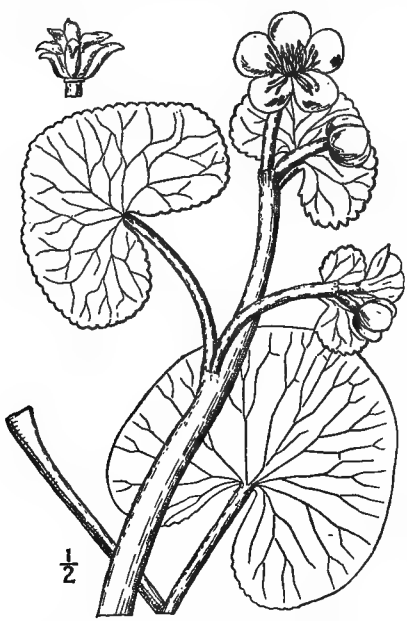


Fig. 85. The marsh marigold (*Caltha palustris*). After Britton & Brown, Ill. Fl. North. U. S.

Family Ceratophyllaceae. Hornwort family. Contains a single genus, *Ceratophyllum*, with three widely distributed species, the most familiar of which is *C. demersum*. It is a submerged aquatic, with capillary or thread-like stems and leaves, found frequently in slow-moving streams. The flowers are without a corolla, and the calyx is many-parted. The fruit is an achene with a long beak, and usually covered with tubercles or provided with spiny appendages.

Family Trochodendraceae. Trochodendron Family. Contains two genera, *Cercidiphyllum*, with two species, and *Trochodendron*, which is monotypic. They are Japanese trees, formerly included in the Magnoliaceae, but distinguishable on account of their peculiar flowers, which are entirely destitute of perianth. The numerous stamens are deciduous, surrounding the 5-8-celled ovary. The leaves are borne in whorls, a character from which the names of both genera are derived.

Family Ranunculaceae. Crowfoot or Buttercup Family. Contains about 40 genera and over 1000 species, natives of temperate or even arctic regions, remarkably scarce in the tropics. They are herbs or rarely climbing shrubs, with watery and acrid juice, simple or compound leaves, and flowers usually with both calyx and corolla, the

sepals and petals distinct. The stamens vary from few to many, and are hypogynous, or inserted on the receptacle beneath the pistils.

On account of the ease with which the floral parts of most Ranunculaceae can be examined, this family has long been a favorite with amateur students, and in the old sequence established by Bentham and Hooker, the Ranunculaceae were placed at the head, chiefly on account of their simplicity of structure. In many respects the group as it stands is an artificial one, for it includes plants with berry-like fruit, as in *Actaea* and its relatives; plants bearing achenes, like the crowfoots; and plants with small capsules or follicles like the columbine and larkspur. But while the genera have of late years been frequently divided, *Hepatica* being removed from *Anemone*, and *Atragene* from *Clematis*, for example, the family has been treated as an aggregate.

Fig. 86. The early meadow-rue (*Thalictrum dioicum*). After Britton & Brown, Ill. Fl. North. U. S.

Members of the Ranunculaceae are among the first flowers to welcome us in early spring. The hepatica, well shown in the beautiful accompanying photograph, unfolds its fuzzy flower buds on rocky slopes with the first balmy breath of spring, often when crevices of the adjacent cliffs are still sealed with snow. A little later, various species of *Ranunculus* brighten the open woodlands and pastures with flecks of golden yellow, a color reflected from the near-by swamps in the flowers of the marsh-marigold (*Caltha palustris*). The anemone and the rue-anemone help to carpet the ground, while the feathery, grayish-white masses of meadow-rue (*Thalictrum dioicum*) give a ghostly suggestion to the woods. In midsummer various forms of clematis serve as a reminder of the family.

The beauty of most ranunculaceous flowers in the wild state has rendered it unnecessary to develop them to a marked degree in cultivation, but the larkspurs have been greatly improved, while the genus *Paeonia*, which has its headquarters in eastern Asia, has attained a wonderful prominence in the hands of the horticulturists. Many of the large double paeonies are fully equal to roses in the beauty of their coloring, and in delicacy of texture. The columbines, moreover, being

a group in which there is naturally a wide range of color, have responded well to hybridization, and may now be found in almost all shades of yellow, red, blue and white.

Owing to the acrid and caustic principle that pervades the herbage and more particularly the roots of many members of the Ranunculaceae, several important drugs and poisons, such as aconite and hellebore, are derived from them.

Family Lardizabalaceae. Lardizabala Family. A small Asiatic family of seven genera and eleven species, interesting chiefly as ornamental shrubs. *Akebia quinata*, a Japanese woody vine with lurid purple flowers, palmately lobed leaves, and odd green fruit, is now commonly cultivated in this country.

Family Berberidaceae. Barberry Family. Consists of eight genera and about 140 species, most of which belong to *Berberis*. The group consists of herbs or shrubs, which may be known by the flowers having imbricated petals, and stamens of the same number as the petals, and placed opposite them. The pistil is simple, becoming in fruit a berry or a capsule.

The Berberidaceae was made by older systematists to include the Lardizabalaceae. Its relationship to the other families discussed in this chapter may be traced by means of the hypogynous petals and stamens. *Berberis*, the most important genus, is represented by a number of pinnate-leaved species native in western North America, and by many exotics of the simple-leaved group in cultivation. The pendent racemes of variously colored flowers, succeeded by the showy berries, are highly ornamental. The fruit of the common barberry (*B. vulgaris*) makes an excellent preserve, while the bark of several species is used in the manufacture of dyes.

The mandrake or may-apple (*Podophyllum peltatum*)) one of our familiar eastern wild flowers, belongs to this family, as does also the twin-leaf (*Jeffersonia diphylla*), and the blue cohosh (*Caulophyllum thalictroides*). The large leaves of the mandrake, curiously suggestive of umbrellas, conceal beneath their ample expanse a handsome waxy white flower, possessing a peculiar pineapple-like fragrance. This is succeeded by a lemon-shaped fruit of a disgustingly mawkish flavor, which, as Dr. Gray once observed, is "eaten by pigs and boys." The Berberidaceae as a group are confined to temperate regions, and find the center of their distribution in the Chino-Japanese region.

Family Menispermaceae. Moonseed Family. A group of twining herbaceous or woody vines, comprised in about 55 genera and 150 species, natives mostly of tropical regions, with only a few representatives in the temperate zone. The family is at once distinguished by the peculiar curved embryo in the seed, which may be plainly seen in cross-

Fig. 87. The hepatica, *Hepatica Hepatica*. After photograph by Mr. Carl Krebs, Cleveland, Ohio.

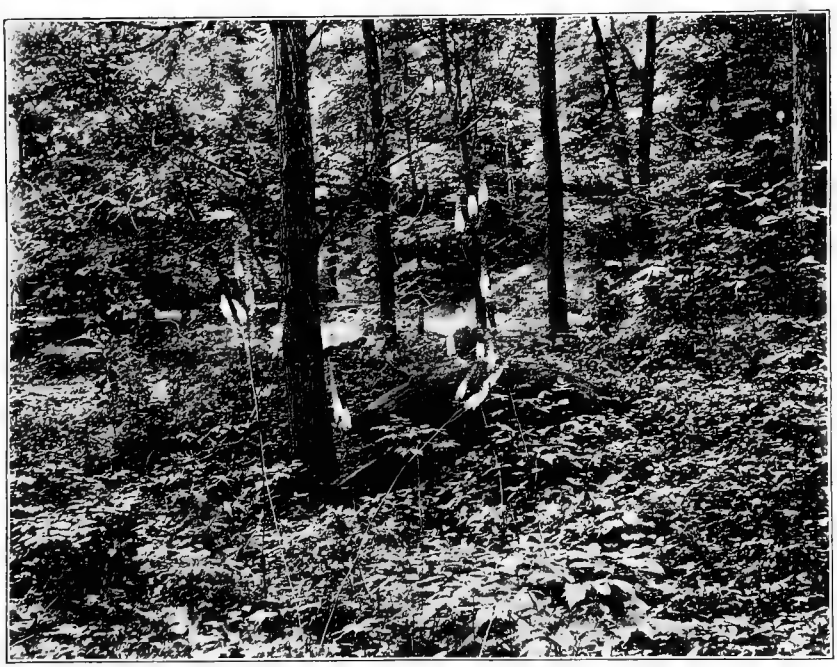


Fig. 88. The bugbane, *Cimicifuga*. After photograph by Mr. Carl Krebs, Cleveland, Ohio.

section. The flowers are small and dioecious, borne in clusters, and have from 4 to 6 sepals, 6 petals, an equal number of stamens, and from 3 to many pistils. The fruit is a berry.

In the northern States we have only the common moonseed (*Menispermum Canadense*); this is reinforced in the South by the cupseed (*Calycocarpum Lyoni*), a handsome vine with large grape-like fruits; and by the Carolina moonseed (*Cebatha Carolina*). The family as a whole has bitter and narcotic properties, and some plants belonging to it are extremely poisonous. The tropical *Cissampelos Pareira* yields the well known tonic, Pareira brava.

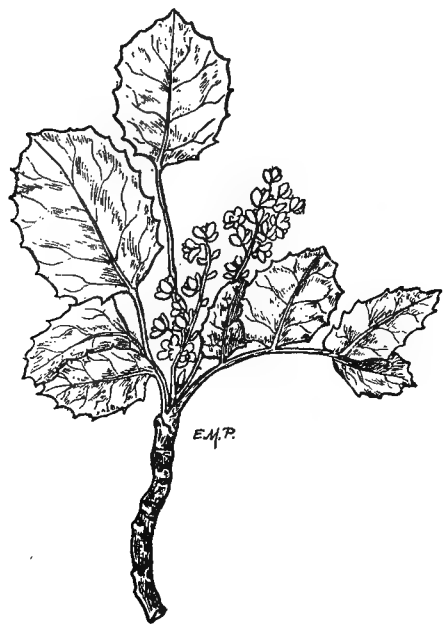


Fig. 89. The dwarf barberry (*Berberis nana*), one-third natural size. Original.

Family Magnoliaceae. Magnolia Family. Contains about ten genera and 70 species, of very wide geographic distribution. All are trees or shrubs with alternate, entire leaves, and large flowers having 3 sepals and 3 petals, innumerable stamens, and very numerous carpels borne on an enlarged base or receptacle, and ripening into one- or two-seeded follicles or achenes, still coherent in a mass. The tulip-tree or white poplar (*Liriodendron tulipifera*), a flower of which is shown in the accompanying figure, is of immense value not only as a timber tree, but as an ornamental shade tree when growing singly near a dwelling. The native species of *Magnolia*, while all handsome when in flower, are ex-

celled in this respect by numerous Asiatic species, most of which differ from our forms in flowering before the leaves appear in early spring. Probably the handsomest of our native Magnolias is *M. foetida,* which is evergreen-leaved, and which in the extreme South attains very lofty proportions. In this region grows also *Illicium Floridanum,* a shrub with dark green leaves and reddish-purple flowers, suggestive of a

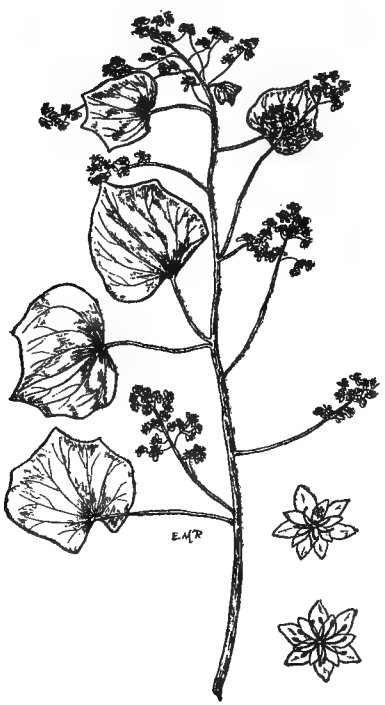


Fig. 90. Flowering branch of moonseed (*Menispermum Canadense*) one-third natural size. Original.

diminutive Magnolia. Like all the plants belonging to this family, it possesses bitter and aromatic properties.

Family Calycanthaceae. Calycanthus Family. Contains the two genera *Butneria,* formerly known as *Calycanthus,* and *Chimonanthus.* They are shrubs having very fragrant flowers, which in the former genus exhale the odor of strawberries, whence the name "strawberry shrub." The sepals and petals are very numerous and imbricated; the stamens innumerable; the pistils also innumerable, and enclosed in the hollow, calyx-like receptacle; from this peculiar character is derived

Fig. 91. Flowering branch of the tulip-tree (*Liriodendron tulipifera*). From Bulletin 73, Vermont Agricultural Experiment Station, by Miss Anna Clark. Loaned by the University of Vermont.

the name "calycanthus," meaning "calyx-flower." There are three species of *Butneria*, all natives of this country, and two of *Chionanthus*, a Chino-Japanese shrub frequently cultivated in gardens, where it often blooms in midwinter. The family possesses no economic value, so far as I am aware.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XVIII.—*Continued.*

Family Lactoridaceae. Lactoris family. Consists of a single genus, which in turn is monotypic, the species being *Lactoris Fernandeziana*, native of the island of Juan Fernandez. It is a low shrub with jointed branches, fleshy leaves and axillary inflorescence.

Family Anonaceae. Custard-apple Family. Contains 46 genera and about 600 species, widely distributed throughout the tropics, but very few extending into the temperate zone. The plants are trees or

Fig. 92. The pygmy papaw (*Asimina pygmaea*), one-third natural size. Original.

shrub possessing more or less aromatic properties; they have alternate entire leaves and rather large solitary flowers, with 3 sepals and about 6 petals, thus presenting an anthotaxy or floral arrangement somewhat unusual among exogenous plants. The stamens and carpels are variable, the latter usually fleshy in fruit.

Fig. 93. Fruiting branch of nutmeg (*Myristica fragrans*), one-half natural size. Original.

The common papaw, *Asimina triloba*, is familiar to residents of the southern States and of the Ohio and Mississippi valley regions. The lurid purple flowers of this tree, appearing with the leaves in early spring, are quite ornamental, while the oblong yellowish fruits have a rich flavor when ripe, superior in the writer's opinion to that of the banana. There are other species of *Asimina* in the far South. None of them attain the dignity of arborescence, but some have very large and handsome flowers (see Fig. 92.) In the West Indies the related genus *Anona* yields several much-prized tropical fruits. The soursop is the product of *A. muricata;* it has a white pulp and a pleasant subacid flavor, the outer rind being greenish and covered with prickles. The sweetsop is the fruit of *A. squamosa;* it is sweeter but also more tasteless. *Uvaria*, which is common throughout the Indo-Malayan region, consists wholly of climbing shrubs; the fruit is occasionally edible, but the genus is chiefly valuable on account of the variety of medicinal substances extracted from roots, bark, flowers and seeds in the different species. The South American genus *Xylopia* is similarly useful.

Fig. 94. California nutmeg (*Umbellularia Californica*) shawing fruit and detached flower, the former reduced, the latter enlarged one-half. Original.

Family Myristicaceae. Nutmeg Family. Consists of the single genus *Myristica*, including about 80 species, natives of the tropics of

both hemispheres, but particularly abundant in southern Asia. They are lofty trees having alternate simple leaves and small monoecious or dioecious flowers destitute of corollas; the stamens are from 3 to 12, the ovary with one to several carpels. The fruit is succulent, enclosing a single nut-like seed, closely invested with a membrane known technically as an aril. This false membrane, when dried and ground, constitutes the spice called mace. It is of a bright red color when fresh, but later turns dark brown. The nutmeg is also sun-dried before being packed for shipment, and the outer shell is usually removed. Commercial nutmegs are yielded by several species of *Myristica*, but the best, known as the Penang nutmeg, is the fruit of *M. fragrans*. (See Fig. 93.)

Family Gomortegaceae. Gomortega Family. This group resembles the Lactoridaceae in being monotypic, consisting of a single genus and species, *Gomortega nitida*, a Chilean evergreen shrub.

Family Monimiaceae. Monimia Family. Contains about 23 genera and 150 species, natives of South America and Australasia. They are trees or shrubs with opposite leaves and monoecious flowers. The divisions of the perianth are all similar, and are borne in several rows; stamens indefinite; carpels several, becoming achenes in fruit, enclosed within the persistent perianth. The herbage, as well as the bark, is fragrant and aromatic, indicating a relationship to the succeeding family; the plants possess little economic value, except that the fruits of a few species are edible.

Fig. 95. The bloodroot (*Sanguinaria Canadensis*). After Britton & Brown, Ill. Fl. Northeast. U. S.

Family Lauraceae. Laurel Family. The highly aromatic trees and shrubs of this important group, are distributed in about 40 genera and over 900 species, common in tropical, but rather scarce in temperate regions. They have simple, usually alternate leaves, and small perfect, monoecious or dioecious clustered flowers. The corolla is wanting; the calyx is 4-6 parted, bearing the stamens inserted in groups of three; ovary 1-celled, becoming in fruit a 1-seeded berry or drupe.

One of the earliest shrubs to indicate the approach of spring in the eastern States is the spice-bush (*Benzoin Benzoin*); its tiny honey-yellow

flowers are borne in such profusion on the leafless branches, that the swamp at a little distance has a distinctly yellowish cast. The sassafras blooms somewhat later, its green twigs and peculiarly shaped leaves rendering it conspicuous at any season of the year. On the Pacific coast the California nutmeg (*Umbellularia Californica*) is a handsome evergreen-leaved tree with plum-like fruit. (See Fig. 94.) In the South several species of *Persea* occur, a genus represented in the tropics by the avocado or Alligator pear (*P. gratissima*). In Europe the bay laurel (*Laurus nobilis*) possesses historical interest from the fact that it furnishes the original "laurel" used to crown the heads of heroes of antiquity. Bay leaves are extensively used as a flavoring herb in soups, stews, etc.

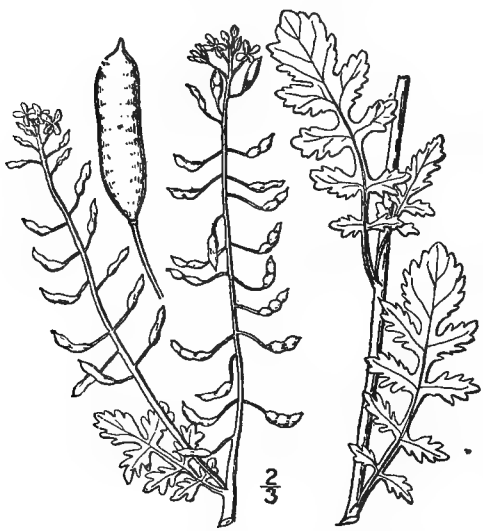


Fig. 96. The yellow water-cress (*Roripa palustris*), showing an enlarged pod. After Britton & Brown, Ill. Fl. Northeast. U. S.

In Asia there are two lauraceous trees of economic interest, the cinnamon (*Cinnamomum Zeylanicam*) and the camphor (*C. Camphora*). Recently some experiments in the cultivation of the camphor tree have been made under the auspices of the Department of Agriculture along the southern Atlantic seaboard, with a fair degree of success. In British Guiana occurs the greenheart (*Nectandra Rodiaei*), which yields an ash-colored bark known as bebeeru; it is used medicinally as a tonic and febrifuge. Another species of *Nectandra* grows in south Florida, and is handsome on account of its panicles of creamy-white flowers.

Mention should also be made of a peculiar genus (*Cassytha*), usually classed with this family, although it should be more properly separated as a distinct group. The species are leafless twining parasitic vines.

Family Hernandiaceae. Hernandia Family. Contains 4 genera and about 20 species, natives of tropical regions, and formerly included in the Lauraceae, which they resemble in structure. They possess no especial economic interest.

CHAPTER XIX.

Order Rhoedales or Papaverales

This group is characterized by the regular flowers, usually with both calyx and corolla. The stamens are hypogynous; the carpels two or more, united into a compound ovary. The plants are almost all herbs, with a watery or milky and often pungent juice. The order includes six families, the Papaveraceae, Cruciferae, Tovariaceae, Capparidaceae, Resedaceae and Moringaceae.

Family Papaveraceae. Poppy Family. Contains about 25 genera and 200 species, of wide distribution, but most abundant in the north temperate zone. They are herbs or rarely shrubs, with milky juice, alternate leaves, and solitary or clustered flowers. The sepals ore usually only two, and caducous, that is, they fall as soon as the blossom expands. The petals are from 4 to 6; stamens few to many; ovary one-celled, capsular in fruit.

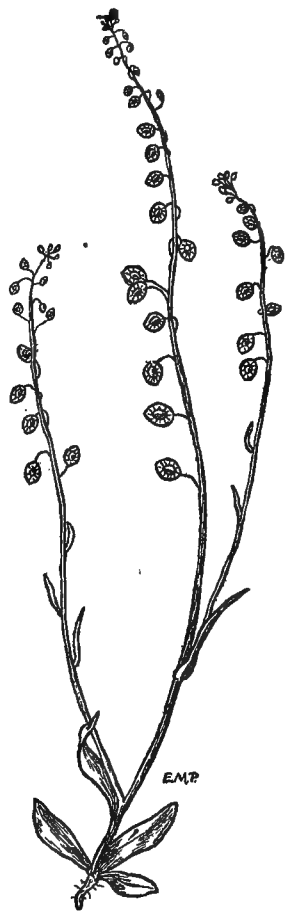


Fig. 97. The lace-pod (*Thysanocarpus curvipes*) about two-thirds natural size. Original.

The Poppy family furnishes us with a number of highly ornamental plants. The true poppies (*Papaver*) are natives of the Old World, and have been so much improved by long cultivation that we now have varieties in all shades of red, white and yellow, with single, semi-double or very double flowers, in both annuals and perennials. The California poppies, which are the delight of every visitor to the Pacific coast, belong to the genus *Eschscholtzia;* they have finely dissected leaves and yellow or orange flowers. In this region also occur several shrubby genera, like *Romneya* and *Dendromecon.* The prickly poppy (*Argemone*) is introduced from the tropics as a weed in certain parts of the country, while the bloodroot (*Sanguinaria Canadensis*), shown in Fig. 95, is familiar to everyone.

A group of closely related genera, comprising the Fumariaceae or Fumitory Family, has been included by recent authors among the poppyworts. They may be known by the irregular flowers, having one or

more of the petals spurred at the base. Our common "Dutchman's breeches," species of *Bikukulla*, are good examples of this division of the family.

A narcotic property is present in the milky juice of most Papaveraceae, but is particularly prominent in *Papaver*, and it is from the juice of *P. somniferum* that the drug opium is obtained.

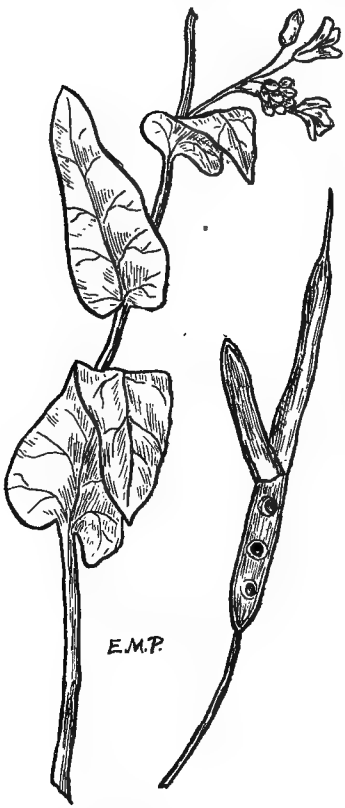


Fig. 98. Flowering branch and separate pod of *Brassica campestris*, the latter with one valve turned back showing seeds; all natural size. Original.

Family Cruciferae. Mustard or Cress Family. The Cruciferae are distinguished easily from related groups by the peculiarity of their stamens, two of which are shorter than the other four; this condition is called *tetradynamous* by botanists. The plants are herbs, with a watery pungent juice, the flowers having 4 petals and 4 sepals after the pattern of a cross, whence the name Cruciferae is derived. The ovary consists of two united carpels, separated by a thin partition; in fruit it becomes a 2-celled pod-like fruit known as a silique; in a few exceptional cases it is indehiscent (not splitting open at maturity), and is then called a loment. While the flowers are very much alike in most of the genera, being white, yellow or pink in color, the differences in the fruit and seeds are very considerable. It is this fact that renders the Cruciferae a very difficult one for the beginner.

The family contains about 190 genera and 1500 species, of very wide distribution, but most abundant in temperate regions. Many of them are common weeds of early spring; others are exclusively alpine; a few are garden vegetables, and some are even cultivated for ornament. Figure 96 shows one of the yellow marsh cresses of the genus *Rorippa*, which also includes the common water-cress. Another type of fruit may be seen in the next illustration (Fig. 97), which represents a delicate little Californian annual known as lace-pod (*Thysanocarpus curvipes*).

The cabbage and turnip belong to the genus *Brassica*, the former vegetable consisting of the mass of young leaves compacted into a

"head," the latter of the enlarged root. Mustard is derived from the seeds of another species of *Brassica;* the genus is illustrated in Fig. 98. The radish is the root of *Raphanus sativus;* while horse-radish is the dried and pulverized root of *Rorippa Armoracia.* Among ornamental crucifers may be mentioned the stock (*Matthiola*), the rocket (*Hesperis*), the candytuft (*Iberis*), and the sweet alyssum (*Konig maritimum*).*

Family Tovariaceae. Tovaria Family. Consists of a single genus and species, *Tovaria pendula*, a tropical American herb with an odor resembling that of celery, and structurally similar to the caperworts.

Family Capparidaceae. Caper Family. Contains about 35 genera and 400 species, natives chiefly of warm regions, and comprising both herbs and shrubs. They have simple or palmate leaves and variously clustered flowers. The sepals are from 4 to 8, the petals usually 4, often borne on long claws; the stamens are from 6 to many, all of equal length. The ovary is frequently long-stalked, and becomes in fruit either a capsule or a berry.

Fig. 99. The clammy-weed (*Polanisia graveolens*). After Britton & Brown, Ill. Fl. Northeast. U. S.

Several species of *Cleome* are prominent among the flowers of the western plains, as also two species of *Polanisia*, the "clammy-weed," so called on account of its viscid pubescence (see Fig. 99.) Capers are the preserved flower-buds of a species of *Capparis*, and the industry is an important one in some parts of Europe.

Family Resedaceae. Mignonette Family. Contains 6 genera and about 55 species, belonging mostly to the Old World. They are herbs with alternate leaves and unsymmetrical flowers, borne in spikes or racemes. The calyx is 4-7 parted, the petals similar; stamens usually numerous; ovary compound, becoming in fruit a many-seeded capsule.

* Odd as this name may appear to the uninitiated, the genus was first published by Adanson with this designation, and by a consistent application of the rule of priority in nomenclature, must remain with unchanged orthography. The plea that such a name is not correctly Latinized is without force when one considers the numerous etymological barbarities now in use.

(See Fig. 100.) *Reseda* is the most important genus, and includes the fragrant garden mignonette (*R. odorata*). A yellow dye and paint is obtained from the yellow-weed or dyers'-weed of Europe, *R. Luteola.*

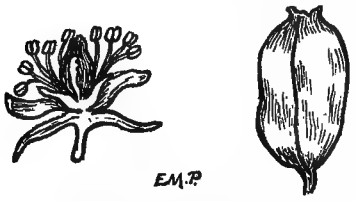


Fig. 100. Flower and fruit of dyer's weed (*Reseda Luteola*) twice natural size. Original.

Family Moringaceae. Moringa Family. Consists of a single genus, *Moringa*, with 3 species, natives of southern Asia. They are trees with pinnate leaves and clusters of rather conspicuous flowers, the calyx and corolla each with five divisions; stamens 8 or 10; ovary simple, stalked, becoming in fruit a 3-valved spongy capsule. The winged seeds of *M. pterygosperma* are called ben-nuts, and yield a clear fluid oil much used by watchmakers; the roots are pungent, like those of the horseradish.

Fig. 102. The huntsman's cup in its natural haunts. From MacMillan's "Minnesota Plant Life," by courtesy of the author.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XX.

Order Sarraceniales.

This interesting group of three families, Sarraceniaceae, Nepenthaceae and Droseraceae, is justly celebrated on account of the wonderful adaptability of the leaves as insect traps. The plants are all herbs, frequently of scapose or stemless habit, with solitary or racemose flowers having the ovary free from the calyx, becoming a capsule in fruit. The leaves vary in the different families; in Sarraceniaceae and Nepenthaceae they form hollow receptacles which serve to catch and retain water; numerous insects crawl into the "pitchers," and being unable to escape, fall to the bottom, where they are gradually macerated, the liquid being ultimately absorbed. In Droseraceae the leaf surface, as will be explained later, acts as a trap for small insects. The group as a whole is tropical, although with some representatives in temperate regions.

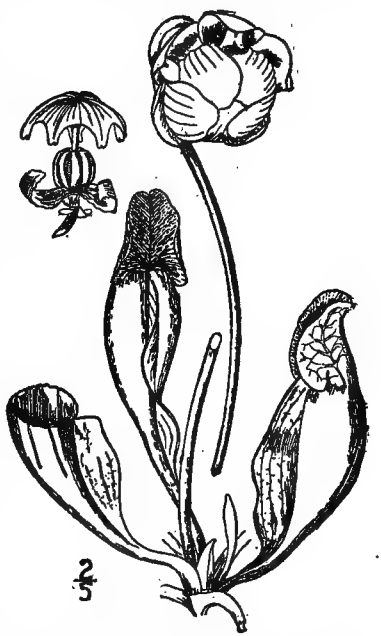


Fig. 101. The huntsman's cup or purple pitcher-plant (*Sarracenia purpurea.*) After Britton & Brown, Ill. Fl. Northeast. U. S.

Family Sarraceniaceae. Pitcher-plant Family. Consists of three genera, *Sarracenia*, *Chrysamphora*, and *Heliamphora*, the last two monotypic, the first containing about 8 species. They are marsh plants with tubular leaves, and large scapose nodding flowers. The sepals are 4 or 5, persistent; the petals 5, or sometimes wanting; stamens numerous; ovary several-celled, with a peculiar peltate (umbrella-shaped) style. (See Fig. 101.)

The distribution of the family is rather remarkable. *Chrysamphora*, the Californian pitcher-plant, belongs only to the Pacific coast, and is remarkable on account of the large, bifurcated hood to the pitchers, suggestive of a fish's tail. *Heliamphora* is confined to the mountains of Venezuela; while the species of *Sarracenia* are among the most conspicuous plants of the southern savannahs and pine barrens, one (*S. purpurea*) extending northward into Canada. The photograph reproduced in Fig. 102 gives an excellent idea of the plant in its natural habitat; its leaves are more graceful in shape than those of any other species. In the South *S. psittacina*, with small red flowers, and leaves curiously resembling the outline of a parrot's head and body, replaces *S. purpurea;* while *S. flava, S. Drummondii* and *S. variolaris* have very large, erect, funnel-shaped leaves, often handsomely variegated.

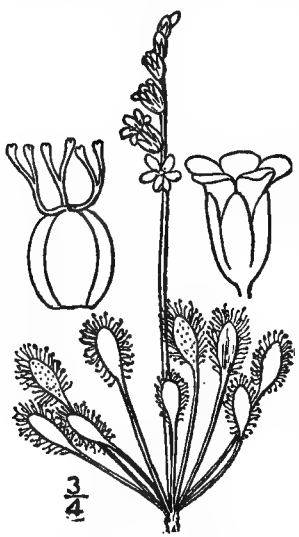


Fig. 103. Spatulate-leaved sundew (*Drosera intermedia*) showing enlarged flower and fruit. After Britton & Brown, Ill. Fl. Northeast. U. S.

The mode in which insects are attracted to these death traps is very ingenious. In most species there is a sweet exudation on the inner surface of the tubular leaf just beneath the protective flaps or hood. Insects crawl down to feed upon this, and soon come upon a smooth polished area, which causes them to slip farther down; a succession of slender hairs, all pointing the same way, renders the remainder of the descent easy, and effectually precludes all attempts of the struggling insects to climb out by the same path.

Family Nepenthaceae. East Indian Pitcher-plant Family. Consists of the single genus *Nepenthes*, embracing about 40 species, natives principally of the Indo-Malayan region, one in Madagascar. They are herbs or somewhat shrubby plants, with dioecious flowers, the sterile containing about 16 anthers united in a head, the fertile with a single 4-celled free ovary; calyx 4-parted, petals none. The leaves are even more remarkable than those of the Sarraceniaceae, for in addition to the pitchers or traps, the petiole develops, in one portion, to a broad expanded blade, fulfilling the functions of an ordinary leaf, and in another portion is tough and wiry, acting as a tendril to support the whole leaf and its contents. The size and shape of the pitchers differ considerably. In many of them the hood forms a perfect lid, closing the mouth of the pitcher completely. Several are in greenhouse cultivation, the most common being probably *N. Rafflesiana.*

Family Droseraceae. Sundew Family. Another interesting family, with a somewhat peculiar geographical distribution. There are six genera; *Drosera*, with about 110 species, occurs in temperate and subtropical regions of both hemispheres, being particularly abundant in Australia; *Dionœa* is a monotypic genus, restricted to a limited area along the coast of North and South Carolina; *Aldrovandra*, another monotypic genus of south Europe and Asia; *Byblis*, with two Australian

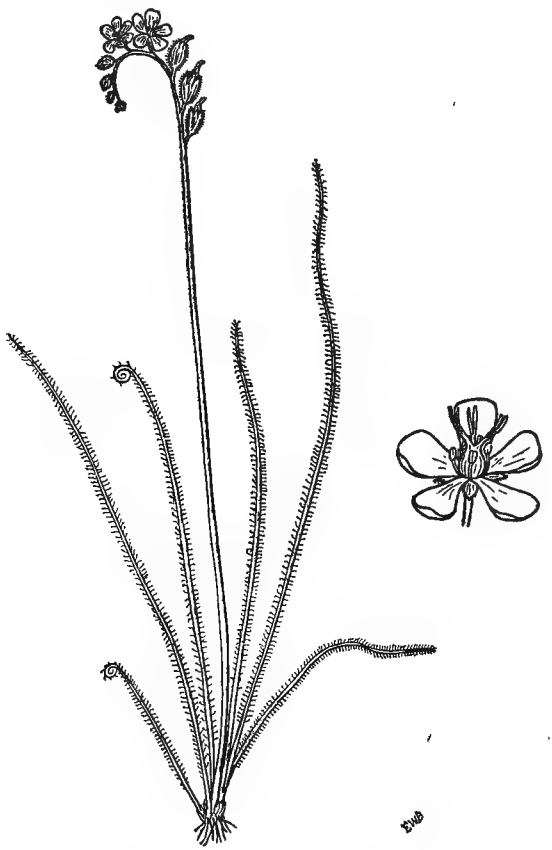


Fig. 104. Thread-leaved sundew (*D. filiformis*). After Berry in Asa Gray Bulletin, Vol. V. No. 5.

species; *Roridula*, with two South African species; and *Drosophyllum*, a monotypic half-shrubby genus of Portugal. With the latter exception, the plants are marsh or aquatic herbs, glandular-pubescent, and exuding a viscid secretion; they are mostly scapose, the leaves in a tuft or cluster at base. The flowers are solitary or racemose, with a 4-5-parted persistent calyx and 5 hypogynous petals; stamens 5-20; ovary 1-3-celled, the style often cleft or divided (see Fig. 103).

Everyone who has penetrated a bog filled with sphagnum moss has noticed the glistening reddish-hued leaves of the round-leaved sundew (*Drosera rotundifolia*), which is our commonest species. Its tiny white flowers open singly, and the curved one-sided raceme elongates just sufficiently to enable the flower of the day to point skyward. *D. filiformis*, with long slender leaves and rose-purple flowers, common in the New Jersey pine barrens and southward, is a more handsome plant (see Fig. 104). An examination of the leaves of *Drosera* under a lens will show a minute drop of viscid fluid at the tip of each hair; this serves to entangle small flies, gnats, etc. In *Dionaea*, however, the process of specialization has gone even farther, and the leaf, which is divided at the midrib into two nearly semicircular fringed lobes, closes like a steel trap the moment any foreign object comes in contact with the slender sensitive hairs of its inner surface. After the imprisoned object is thoroughly digested, the leaves again expand; if a bit of wood or other useless material has been imprisoned, they will open in a few hours.

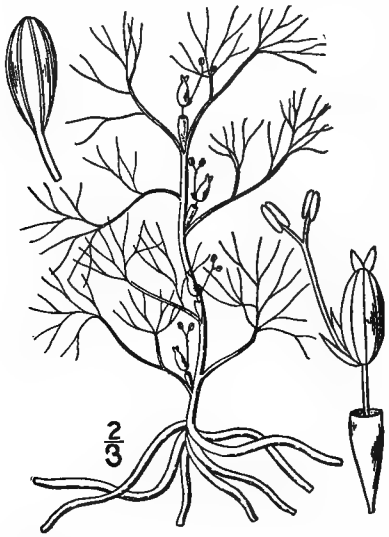


Fig. 105. The common river-weed (*Podostemon Ceratophyllum*). After Britton & Brown, Ill. Fl. Northeast U. S.

CHAPTER XXI.

Order Rosales.

This large and important order, of which the Rose family (Rosaceae) is the type, contains seventeen other families, including the Papilionaceae, Mimosaceae, and Caesalpiniaceae, three groups which collectively comprised the old order Leguminosae, and which include the most valuable of our economic plants. In so large a group as the Rosales, it is difficult to find distinguishing characters which will apply equally well to all the members; but in general the roseworts may be known by the insertion of the stamens, which may be either *hypogynous* (on the axil below the pistil) or *epigynous* (on the pistil itself); by the sepals, which are more or less united or confluent with the receptacle; and by the simple ovary, consisting of one or many distinct or united carpels.

Family Podostemaceae. River-weed Family. Contains about 21 genera and 175 species, all tropical except *Podostemon*, which is repre-

sented by a single species extending throughout the eastern half of the United States. The plants are fresh-water aquatic herbs, exhibiting a primitive type of structure, with little differentiation between leaf and stem. The flowers are without any perianth, and are enveloped at first in a spathe-like involucre. The ovary is frequently stipitate (stalked), becoming a capsule in fruit (see Fig. 105).

Family Hydrostachydaceae. Hydrostachys Family. A group of aquatic plants, consisting of the single genus *Hydrostachys*, closely related to the preceding family.

Family Crassulaceae. Orpine Family. This interesting group of plants, of wide geographic distribution, comprises about 15 genera and over 500 species. They are herbs or half-shrubs, remarkable for their fleshy or succulent herbage, the result of adaptation to the arid situations in which many of them are found. The persistent calyx is 4-5-parted; the petals, equal in number, are also persistent; stamens and carpels equalling the petals; the carpels either wholly distinct or slightly united below, becoming small follicles in fruit.

Fig. 106. The American orpine (*Sedum telephioides*) with detached flower enlarged. Original.

Sedum, the stone-crops, includes many North American species. The American orpine or live-for-ever (*Sedum telephioides*) is one of the most attractive, with the light green foliage and clusters of pink flowers (see Fig. 106). A European species (*Sedum acre*) having bright yellow flowers, is frequently seen in cultivation. In southern Europe and northern Africa species of *Echeveria* and *Sempervivum* are very common, growing frequently on the roofs of houses and on old walls.

Family Saxifragaceae. Saxifrage Family. Contains about 70 genera and 600 species, natives mainly of temperate regions, many being alpine. They are herbs, shrubs, or even trees, with solitary or vari-

ously clustered flowers. Sepals and petals usually 5, the stamens equal or twice as many in number; carpels one or more, generally 2, distinct or partly united; fruit a capsule, follicle, or berry.

Saxifraga is by far the largest genus, comprising over 200 species, all of which are perennial herbs. While the group is quite a natural one, its subgenera are strongly marked. Thus some species have solitary yellow flowers; others dense panicles of creamy white blossoms; in still others the flowers are pink.* Numerous other genera are represented in the United States, one of the most interesting being *Heuchera*, which is characterized by large simple basal leaves and scapes terminated by panicles of delicate flowers, white or variously-colored (see Fig. 107). The various hydrangeas, several of which may be ranked among our most desirable hardy shrubs for lawn planting, belong to this family. The conspicuous florets in a cluster of hydrangea blossoms are "neutral," that is, they are without stamens or pistils. Sometimes the whole cluster is sterile in this manner. *Philadelphus*, the mock-orange, or, as it is altogether falsely called, "syringa," belongs here, as does also the

Fig. 107. Alum-root (*Heuchera Americana*). After Britton & Brown, Ill. Fl. Northeast. U. S.

Fig. 108. Grass-of-Parnassus (*Parnassia palustris*). After Britton & Brown, Ill. Fl. Northeast. U. S.

*See article "Concerning Saxifrages," by T. H. Kearney, Jr., THE PLANT WORLD, **3**: 37. 1900.

handsome climbing shrub of our southern States, *Decumaria.* Mention should also be made of the anomalous genus *Parnassia*, the "grass-of-Parnassus," which is now very generally referred here, though it might better be made the type of a distinct family. The flowers are remarkable for the clusters of staminodia (imperfect stamens) borne at the base of each petal (see Fig. 108).

Family Grossulariaceae. Gooseberry Family. Contains only the genus *Ribes*, with about 75 spacies, natives of the north temperate zone. Besides the garden gooseberry (*R. Uva-crispa*) and the currant (*R. rubrum*), the genus contains several species ornamental in cultivation. All are shrubs, with alternate leaves and flowers having the tube of the calyx entirely united with the ovary, and the 4 or 5 small petals borne on the calyx. The ovary has 2 distinct or united styles, and becomes in fruit a pulpy berry, crowned by the persistent calyx.

Fig. 109. The southern witch-hazel (*Fothergilla Carolina*); a flowering branch with detached enlarged capsule. Original.

Family Cephalotaceae. Cephalotus family. A monotypic family, consisting of the Australian plant *Cephalotus follicularis*, which calls to recollection the pitcher-plants. It is a very short-stemmed herb, with spoon-shaped or stalked leaves; the "pitchers" are short and thick, with a lid like those of the Nepenthaceae, the rim being fringed with hairs. The singular feature about these pitcher-like bodies, however, is that they are entirely distinct from the true leaves, being borne on separate stalks. The flowers are borne in a long spike, and are destitute of corolla.

Family Pittosporaceae. Pittosporum Family. Contains 9 genera and about 100 species, chiefly confined to Australasia. They are shrubs or trees, with regular 5-merous flowers and a 2-5-celled ovary which becomes in fruit a berry, frequently edible. Some of the trees yield resins and gums; they are usually called maple or mapau in New Zealand.

Family Brunelliaceae. Brunellia family. Consists only of *Bru-*

nellia, a genus of South American and Hawaiian trees, resembling the prickly-ash (*Xanthoxylum*) in structure and appearance.

Family Cunoniaceae. Cunonia Family. Contains about 20 genera and 120 species, natives of the southern hemisphere. They are shrubs or trees with opposite leaves, differing from related groups by the presence of stipules. The trees of the large genus *Weinmannia* afford a light wood suitable for cabinet-making, and the astringent bark is used for tanning.

Family Myrothamnaceae. Myrothamnus Family. Consists of one genus, *Myrothamnus*, with several South African species.

Family Bruniaceae. Brunia Family. Contains 5 genera and about 50 species, all low, heath-like shrubs of South Africa and Madagascar. Though differing very much from the following family, they are not materially distinct in structure, except that the leaves are without stipules.

Family Hamamelidaceae. Witch-hazel family. Includes 15 genera and 35 species, natives of North America, South Africa and Asia. They are trees or shrubs with simple, alternate leaves, and perfect or polygamous flowers, often lacking a perianth. The ovary consists of 2 carpels, becoming in fruit a 2-valved woody capsule. *Hamamelis*, the witch-hazel, is well known in our eastern States, through its peculiarity of blooming in the late fall when the leaves are dropping. *Fothergilla*, a closely allied genus of the southern States is shown in Fig. 109. *Liquidambar*, the sweetgum, is a handsome forest tree.

Family Platanaceae. Plane-tree Family. Comprises only the genus *Platanus*, with about 7 species, the best known of which is the common plane-tree, button-wood or sycamore (*P. occidentalis*). The flowers are monoecious, in dense globular heads. The hollowed petiole-bases of the leaves fit over the bud for the ensuing year like a cap. This family is obviously related to the Hamamelidaceae, and is now placed next to it, although widely separated in the old sequence of Bentham & Hooker.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXI—*Continued.*

Family Crossosomataceae. Crossosoma Family. Consists of the genus *Crossosoma*, with two species, natives of our southwestern border, extending into Mexico. They are shrubs with small coriaceous leaves and white flowers with a superior ovary composed of a number of separate carpels (see Fig. 110). The genus is an anomalous one, and has been placed by some botanists in the Ranunculaceae, by others in the Dilleniaceae, but it is best regarded as the type of a distinct group.

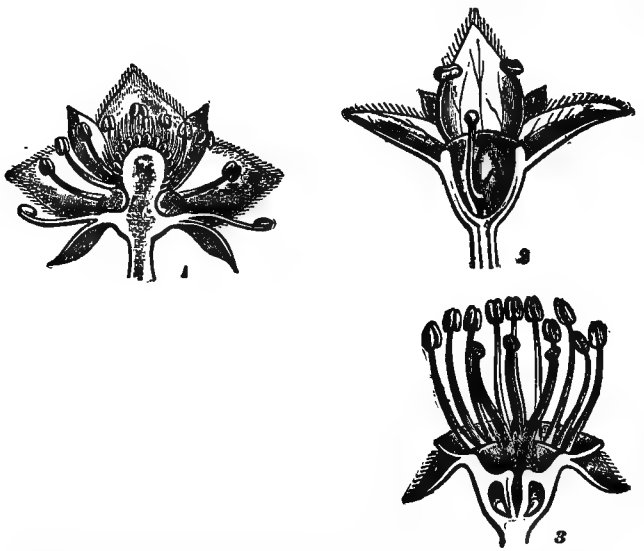
Fig. 110. Flowering branch and enlarged flower of the southwestern desert shrub, *Crossosoma Bigelovii*. Original.

Family Rosaceae. Rose Family. The modern tendency toward the recognition of smaller and more sharply defined natural families of plants is well exemplified in the Rosaceae as they now appear in our text-books. The old family included pears, plums, apples and their allies, together with spiraea, cinquefoil, blackberry and strawberry. The apples and pears are now separated as the family Pomaceae, while the plums, cherries, etc., constitute the family Drupaceae. The Rosaceae proper, containing all other genera of the group, are characterized by the regular flowers with 5 sepals, 5 petals, numerous stamens, and 1 to many carpels, distinct or united to the calyx. The fruit is usually an achene; the plants themselves are herbs, shrubs, or rarely trees. There are 65 genera and over 1200 species, of very wide geographic distribution. In Fig. 111 the two uppermost flowers exhibit two distinct types of structure found in this family: the *hypogynous* flower, in which the stamens are borne on the receptacle *beneath* the

carpels, and the *perigynous* flower, in which they are borne on the rim of the receptacle *around* the carpels.

Owing to the vast extent of the family, and the large number of noteworthy plants it contains, we shall find it advantageous to discuss the various subfamilies or general groups in some detail.

The Spiraeoideae are typified by the genus *Spiraea*, represented by numerous wild species throughout the United States, and by several ornamental exotics in cultivation. The spiraeas are mostly undershrubs, with large, dense clusters of small red, pink or white flowers. The petals are borne on the calyx in this group, and the carpels are



From Coulter's Plant Structures. Copyright, 1900, by D. Appleton & Co.

Fig. 111. Flowers of Rose and Apple Families; (1), hypogynous flower of *Potentilla*, the sepals, petals and stamens borne on the receptacle beneath the carpels; (2), perigynous flower of *Alchemilla*, these organs borne on the rim of the receptacle above the carpel; (3), epigynous flower of the apple, the parts arising from the summit of the ovary. After Focke.

comparatively few in number, not exceeding 5. The two species of *Porteranthus*, known as "Indian physic" possess medicinal properties; they are herbs, with graceful foliage and delicate white flowers. *Quillaja Saponaria*, a Chilean tree, has bark which yields saponin in abundance from which a very good quality of soap is manufactured.

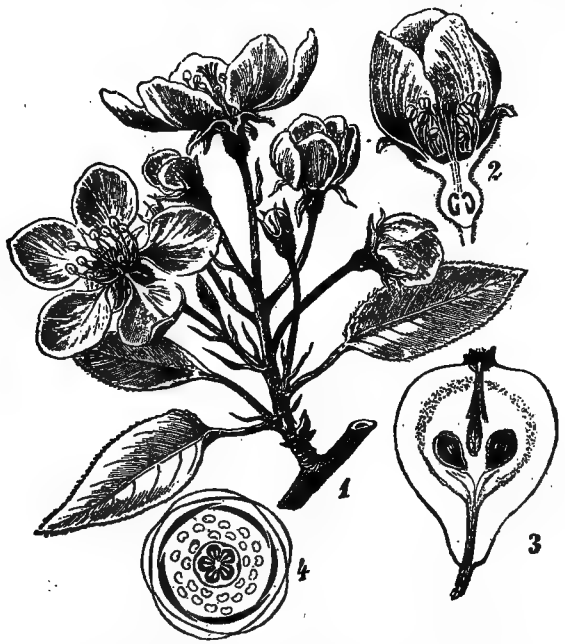
In the subfamily Rosoideae, we note a handsome Asiatic shrub (*Kerria Japonica*), whose golden-yellow double flowers have been conspicuous in the Washington parks during the past few weeks. *Potentilla* may be ranked as the largest of the few rosaceous weed genera in this country; it includes about 150 species, natives of the north temperate zone, and with very few exceptions herbaceous in habit. They have

yellow, rarely purple or white flowers, and either palmate or pinnate compound leaves, those of the palmate type being frequently composed of five leaflets, so that the plants have received the name of cinquefoil or five-finger. The closely allied genus *Comarum* illustrates practically the same type (see Fig. 112). The tormentil (*P. Tormentilla*) is the only species possessing marked medicinal properties. *Fragaria*, the strawberry, is another genus whose members are mainly of northern distribution. Wild strawberries, of one sort or another, occur throughout the country; and we are all familiar with the advances made by horticultural science in the domestic strawberry. It should be pointed out that the edible portion of this fruit consists of the enlarged pulpy axis or receptacle, while the so-called "seeds" embedded on its surface are the real fruits, each being a small one-seeded achene. In the raspberry and blackberry, members of the genus *Rubus*, the fruit is of wholly different structure, consisting of a coherent mass of little stone-fruits or *drupes*, which when ripe pull easily away from the dry columnar receptacle. *Rubus* is likewise of temperate distribution, but its species are found in several continents; they are especially numerous and very difficult to identify in Europe. The little Arctic and alpine herbs belonging to the genus *Dryas* are somewhat similar to the preceding in the appearance of their flowers, but the numerous achenes, when ripe, are tipped with long plumose styles like those of a clematis. In *Geum*, a genus which furnishes some ornamental species, the styles are also persistent, but not always plumose. The same floral structure may be seen in the mountain mahogany (*Cercocarpus*) and several allied trees of the western States. The herb known as agrimony (*Agrimonia Eupatoria*) was formerly of much repute in medicine. Its leaves and rootstocks are astringent, the latter yielding a yellow dye. Several species of this genus occur in the United States; the calyx of the small yellowish flowers is beset with bristly hooks, which furnish a means of artifIcial transportation for the ripe fruit along with other "stick-tights." The burnets belong to the genus *Sanguisorba;* they are tall herbs with spikes of small white flowers. In this

Fig. 112. The marsh cinquefoil or cowberry (*Comarum palustre*). After Britton & Brown, Ill. Fl. Northeast. U. S.

neighborhood also belongs *Cliffordia*, a genus of South African shrubs comprising about 40 species.

The rose (*Rosa*) is naturally the type and most important genus of the Rosaceae. There are very diverse views among botanists as to the number of wild species that should properly be recognized; over 600 have been described, but this number can probably be reduced to 200 or 300. The rose flower has an urn-shaped calyx, five petals, and very numerous stamens and carpels; the latter, when ripe, form 1-seeded



From Coulter's Plant Structures. Copyright, 1900, D. Appleton & Co.

Fig. 113. The common pear (*Pyrus communis*) showing flowering branch (1), section of flower (2), section of fruit (3), and diagram of flower (4). After Wossidlo.

achenes enclosed in the fleshy fruiting calyx, known as the *hip* or *hep*. In cultivation the number of the stamens becomes greatly reduced, and the petals correspondingly increased. No flower responds more readily to the methods of the horticulturalist than does the rose, and hundreds of distinct garden varieties, belonging to many distinct types, are known. The two important economic uses of the rose are in the manufacture of rose water and attar of roses.

Next in the systematic arrangement of the family we find the subfamily Neuradoideae, containing two North African desert shrubs (*Neurada* and *Grielum*).

Family Pomaceae. Apple Family. As above explained, this and the succeeding were formerly regarded as sections of the rose family

Fig. 114. Two views of the shad-bush, *Amelanchier Canadensis*, in full bloom. After photographs by Carl Krebs.

proper. The apples and their allies may be easily distinguished by the fruit, which consists of the enlarged fleshy calyx-tube, enclosing from one to five thin-walled or papery carpels, each usually single-seeded. This structure may be seen in Fig. 113. A fruit of this type is known to botanists as a *pome* (from *pomum*, fruit).

Generic differences in this family are more apparent than real, and indeed the apple (*Malus*), the pear (*Pyrus*), and the mountain ash (*Sorbus*), were until recently generally placed together in the single genus *Pyrus*. But all three belong to very distinct natural types, and one who is absolutely ignorant of botany can distinguish any pear from any apple, and any quince from either.

The family contains about 20 genera and 225 species of wide distribution; all are trees or shrubs. In this country we have very few indigenous species of *Pyrus*, *Malus* or *Sorbus*, but *Amelanchier*, the shad-bush or service-berry, is represented by about 12 species in the United States, while *Crataegus*, the hawthorn, now contains over 100, and the number is rapidly on the increase. Two handsome photographs of the shad-bush (*Amelanchier Canadensis*) may be seen in the accompanying plate (Fig. 114). The cockspur thorn (*Crataegus Crus-galli*) is shown in Fig. 115. Hawthorns are extremely ornamental trees in cultivation, with their white or pink flowers and often brightly colored fruits. Most of the trees are armed with spines; their wood is very hard.

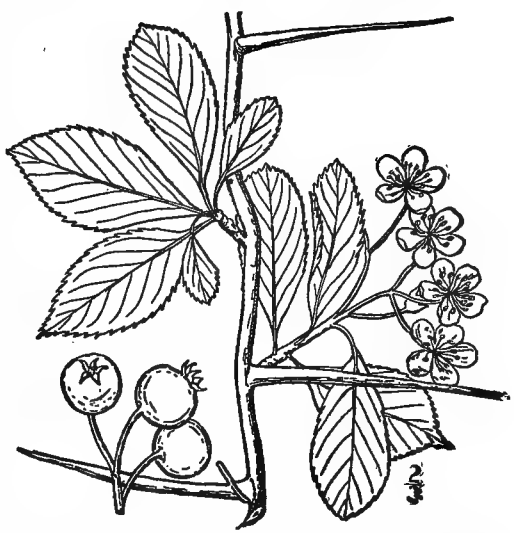


Fig. 115. The cockspur thorn (*Crataegus Crus-galli*). After Britton & Brown, Ill. Fl. Northeast. U. S.

Family Drupaceae. Plum family. Contains about 6 genera and over 100 species of wide distribution, most abundant in the north temperate zone. They are trees or shrubs with resiniferous bark, nearly all parts of the plant containing prussic acid. The flowers have five petals, borne on the calyx, which is free from the ovary; stamens numerous; ovary consisting of a single carpel, becoming what is known as a drupe in fruit, the outer coating being fleshy or pulpy, the inner hard and crustaceous, enclosing a solitary seed. The great majority of the species are comprised in *Prunus*, the plum, and *Cerasus*, the cherry,

which are often united into a single genus under the former name. *Amygdalus*, the peach, though not originally a native of our country, has become extensively naturalized as an escape from cultivation.

It will be seen that the Rosaceae and their allies form a well-defined natural group, with remarkable regularity in the appearance of their flowers (so that the term "rosaceous" is in common use) but with great diversity in fruit structure. The reverse is the case in the pea family and its allies, which we shall consider later. A remarkable feature of the Rosaceae is that the color blue seems to be entirely wanting among the flowers of the various genera.

Family Connaraceae. Connarus Family. This is a connecting link between the great groups already discussed and those which will follow. It contains about 160 species of tropical climbing shrubs, disposed in 16 genera, of which *Connarus* and *Rourea* are the most important. They have flowers of the leguminous type, but the ovary is composed of several carpels.

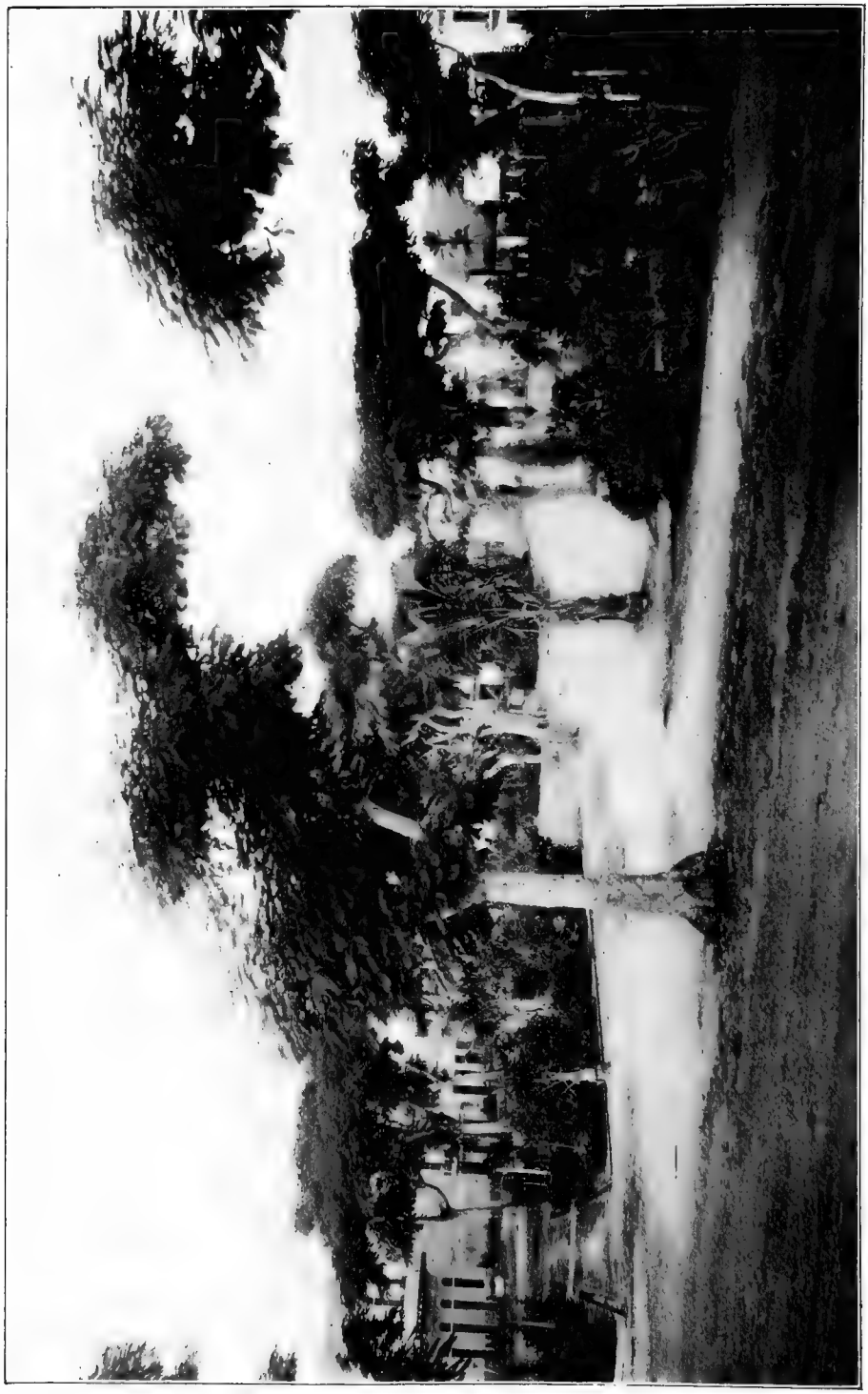


Fig. 117. The Royal Poinciana (*Poinciana regia*) in Porto Rico. After photograph by Mr. G. N. Collins.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXI—*Continued.*

We have now reached one of the largest, probably the most important, and certainly one of the most distinct natural groups in the whole vegetable kingdom; the group known for many years under the name Leguminosae or Pulse Family, and still commonly so called. The name is in allusion to the fruit, which consists of a single more or less fleshy thin-walled carpel, bearing the seeds in one row. It is known technically as a legume, and popularly as a pod, and is so characteristic in appearance, that with very few exceptions any plant of this group may be recognized, when in fruit, as a "leguminous" (legume-bearing) plant.

Recent systematists, considering the remarkable differences in floral structure that obtain among various subdivisions of the Leguminosae, have treated the group as consisting of three families, and this classificatiod is generally followed in America. These families are known as the Mimosaceae, the Caesalpiniaceae, and the Papilionaceae.

Family Mimosaceae. Sensitive-plant Family. Mimosa Family. A group conspicuous in the tropics, very limited in the temperate, and wholly absent from the arctic zones. It includes about 30 genera and 1400 species, the plants being herbs, shrubs or trees. They have alternate leaves, which are nearly always pinnately compound after the pattern of those in the common greenhouse sensitive plant (*Mimosa pudica*). The small perfect and quite regular flowers are borne in heads, spikes or racemes. The calyx is cup-shaped, with from three to six teeth; the corolla with a similar number of distinct or slightly united petals. The stamens vary greatly in number in the different genera, some of them being distinguishable from each other as genera only by the number of stamens. The ovary is of course one-celled, and the fruit a legume, as above explained. Fig. 116 conveys a good idea of the flowering branch of an *Acacia*, which is a typical mimosaceous plant.

Edible fruits are yielded by many tropical trees of this group, particularly by species of *Inga* and *Prosopis*. The latter is the well-known

"mesquite" of Mexico and the southwestern States; the two species occurring within our borders differ strikingly in their fruits, one (*P. pubescens*) having the pods twisted like a corkscrew, so that it is known as screwbean. The true mesquite (*P. juliflora*), has long flattened pods containing "beans" or seeds which are an important article in the dietary of the average Mexican.

The very large genus *Acacia* is represented in all tropical countries. A peculiar feature of its morphology is that the usually decompound leaves, consisting of many leaflets, are in nearly all the Hawaiian and Australian species reduced to flat bodies known as phyllodes, which look exactly like ordinary simple leaves, though somewhat coriaceous (leathery) in texture, and standing vertical instead of horizontal. The most important economic product yielded by the genus is gum, particularly gum-arabic; also, the drug known as catechu. Both these articles are derived from the refined juice or sap. *Adenanthera pavonina*, the red sandalwood of tropical Asia, is one of the most valued timber trees of that region. Its bright scarlet seeds, oddly enough, are very uniform in weight, each being 4 grains, and they are therefore extensively used by Oriental jewelers as weights. While the shrubs and trees of this family are not extensively grown in our greenhouses, they form a very important item in tropical landscape gardening, and in congenial situations they are of great size and beauty. The group is probably more conspicuous in Australia than in any other country.

Fig. 116. A sensitive plant (*Acacia*), showing the flowers with numerous stamens, and the pinnately compound leaves. After Meyer and Schumann.

Family Caesalpiniaceae. Senna Family. Herbs, shrubs or trees, comprised in about 90 genera and 1000 species, chiefly of tropical distribution. They are distinguished by the nearly regular, often rosaceous flowers, with 5 sepals and 5 petals, the upper or odd petal enclosed by the lateral ones; stamens 10 or fewer; fruit a pod.

There are numerous ornamental plants belonging to this group, though it is a matter for regret that most of them are scarcely hardy enough to withstand our temperate climate. *Poinciana regia*, the royal Poinciana, together with many species of *Caesalpinia*, may be ranked among the most showy of tropical trees, whether in flower or fruit (see plate, Fig. 117). The large East Indian genus *Bauhinia*, consisting of climbing woody shrubs with curiously bilobed leaves, has handsome flowers, often of a delicate rose color. In our own country the redbud or Judas-tree (*Cercis*) yields a warm tone to the landscape in early spring with its masses of purple-pink flowers.

Valuable balsams are obtained from most of the species of *Copaifera*, while copal gum is derived from some species of *Hymenaea* and *Trachylobium*. A bitter bark, known as sassy-bark, is furnished by the African red-water tree, *Erythrophloeum guineense*; it is used for medicinal purposes, and by the natives, especially as an ordeal bark. Various species of *Cassia* yield the drug senna, while others are ornamental shrubs. The tamarind (*Tamarindus Indica*) affords a valuable addition to the tropical dietary, the pulp from its pods being utilized in all kinds of preserves, though somewhat unduly acid. The fruit of the carob-tree (*Ceratonia siliqua*), native of Africa, but naturalized in parts of southern Europe, is also edible. Finally, valuable timber is yielded by several trees of this group, but particularly by various species of *Swartzia*, natives of South America. The wood of these trees is very hard and of a fine grain; it is known as Brazil-wood. Fig. 118 illustrates the Kentucky coffee tree (*Gymnocladus dioica*) of our own country. At the end of this family is placed by the German systematists a somewhat anomalous genus, *Krameria*, consisting of about a dozen species, ranging from the southwestern States to Chile. The flowers are quite irregular, like those of some Cassias, and the fruit, although inde-

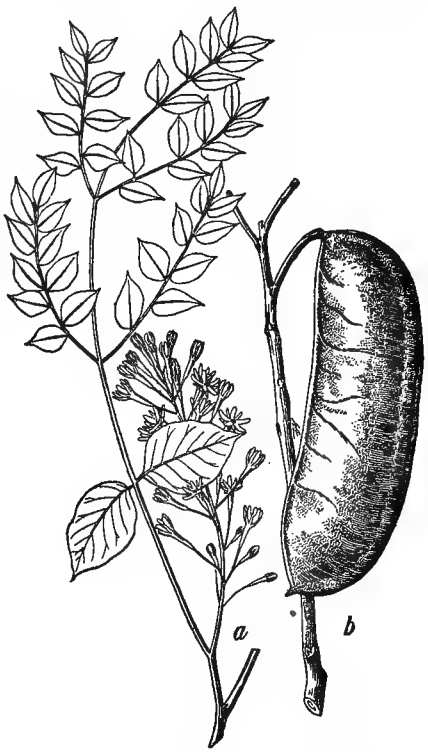


Fig. 118. Kentucky coffee tree (*Gymnocladus dioica*); *a*, young flowering branch, *b*, seed pod. After Chesnut, Bull. No. 20, Div. of Bot. U. S. Dep. of Agric.

hiscent (not splitting open) at maturity, is one-seeded, and structurally a pod. The genus was formerly placed with the Polygalaceae, and by many authors is now regarded as a distinct family.

Family Papilionaceae. Pea Family. This, the typical group of the Leguminosae, is at the same time the largest and most important family of the Order Rosales. The plants range in size from the smallest of herbs to the loftiest of forest trees, and are comprised in about 310 genera and 5000 species, most abundant in tropical and subtropical regions, though some extend to the Arctic zone. The character from

Fig. 119. A leguminous plant (*Lotus*) showing flowering branch; (1), detached flower; (2), clusters of 10 stamens; (3), single carpel; (4), fruit, a pod; (5), petals dissected apart; (6), consisting of standard (*a*); wings (*b*); and keel (*c*); and floral diagram (7). After Wossidlo.

which the family takes its name is found in the peculiar and very irregular shape of the flower (see Fig. 119). The upper petal, usually the largest, is known as the *banner* or *standard;* the two lateral are called *wings*, and the lowermost or forward pair jointly form the *keel*, which usually closely enfolds and protects the stamens and pistil. The latter is 1-celled, forming a pod in fruit. The stamens are usually 10, and may be distinct, diadelphous (united into two sets by their filaments, or monadelphous (similarly united into a single set).

The papilionaceous flower, as it is usually called, is in most of the genera identifiable at sight, but there are some exceptions; thus in *Amorpha* the corolla consists of only one petal, the standard, which is folded over the pistil like the keel in an ordinary flower. So also the

shape of the keel itself is found to vary; the peculiar snout-like shape of the keel in the bean flower is well known. We shall follow the systematic arrangement of the tribes in this family, taking a hasty survey of such genera as are of special importance.

In the tribe Sophoreae the yellow-wood (*Cladrastis lutea*) of our southern States, furnishes us both with a highly ornamental tree and a yellow dye. Several exotic species of *Sophora* are cultivated in gardens, while the South American genus *Myroxylon* yields a fine balsam.

Tribe Podalyrieae. This consists mostly of shrubs with simple or palmately divided leaves. It includes our various wild false indigoes (*Baptisia*) and the large Australian genus *Pultenaea*.

Tribe Genisteae. In this group are a number of well known European plants, such as the "golden shower (*Laburnum vulgare*), the Scotch whin or gorse (*Ulex*), the broom (*Cytisus scoparius*), and the woad-waxen or dyer's weed (*Genista tinctoria*). Several of these have become naturalized in the United States; but the important American genus of this tribe is *Lupinus*, the lupines, comprising a large number of species throughout the western plains and along the Pacific coast. Fig. 120 shows the only lupine of the northeastern States (*L. perennis*). In Florida occur two species with apparently simple leaves, but in reality the leaf is a compound one reduced to a single leaflet, as shown by the joint between blade and stalk. The genus *Crotalaria* is also a large one, and widely distributed through warm regions. The inner bark of *C. juncea*, the "sunn" or Bombay hemp of India, yields a valuable fiber.

Fig. 120. Wild lupine, *Lupinus perennis*. After Britton & Brown, Ill. Fl. Northeast. U. S.

Tribe Trifolieae. This includes the true clovers (*Trifolium*), the yellow hop-clover (*Chrysaspis*), the alfalfas (*Medicago*), and the sweet clovers (*Melilotus*). In Europe are found also the "rest-harrows" (*Ononis*), and the fenugreeks (*Trigonella*). All clover-like plants may be known by the close heads or spikes of small flowers, and by the usually palmate leaves. Those of cold or alpine regions are usually herbaceous, while those of the warmer temperate zone are often shrubs or

undershrubs. Their chief value is as forage or grazing plants and as honey producers.

Tribe Loteae. The genus *Lotus* exhibits considerable diversity, both in habit and in the color of its flowers. It is widely represented in the Pacific States, and also in Europe.

Tribe Galegieae. The large genus *Indigofera* is well known on account of the beautiful blue dye yielded by *I. tinctoria* and *I. Anil.* Ornamental garden plants are afforded by wisteria (*Kraunhia*) and locust (*Robinia*), the native pink flowered species of which are very beautiful. The Liberian pea tree (*Caragana*) is also ornamental, and is of considerable economic value in the regions where it occurs. The bark furnishes tough cordage, and the seeds are good food for poultry. On our western plains the traveler will notice the great abundance and variety of species of *Astragalus* and related genera. These are herbaceous plants of clover-like appearance, but decidedly opposite in the character of their herbage, since many of them are "loco" weeds, and are extremely poisonous to cattle. The licorice tree (*Glycyrrhiza*) yields the familiar sweet drug of our childhood.

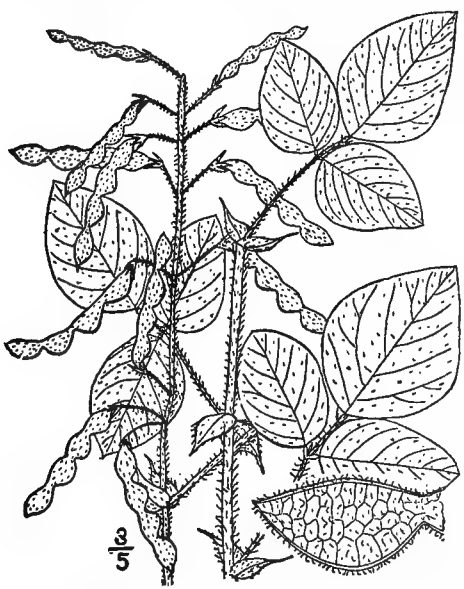


Fig. 121. The hoary tick-trefoil *Meibomia canescens.* After Britton & Brown, Ill. Fl. Northeast. U. S.

Tribe Hedysarieae. This includes some European genera valuable for forage purposes, notably *Onobrychis* and *Coronilla.* It also includes that toothsome product of our southern States, the peanut (*Arachis hypogaea*). The tick-trefoils (*Meibomia*) are common and troublesome weeds whose jointed pods are beset with fine bristles, giving them abundant opportunity to travel about and seek new abiding places through the agency of the passer-by (see Fig. 121). *M. gyrans,* of India, the telegraph-plant, is said to indicate approaching storms by the movement of its sensitive leaflets.

Tribe Dalbergieae. The tropical genera *Dalbergia, Machaerium* and *Pterocarpus,* besides being ornamental, furnish useful timber. *Dipteryx odorata* yields the tonka bean, which is extensively used by

perfumers in the manufacture of sachet powders and other perfumes. The odor is due to a principle known as *coumarin*.

Tribe Viceae. From the economic standpoint this and the following are the most important groups of the Papilionaceae. The genus *Pisum* comprises all forms and varieties of the cultivated pea, while the

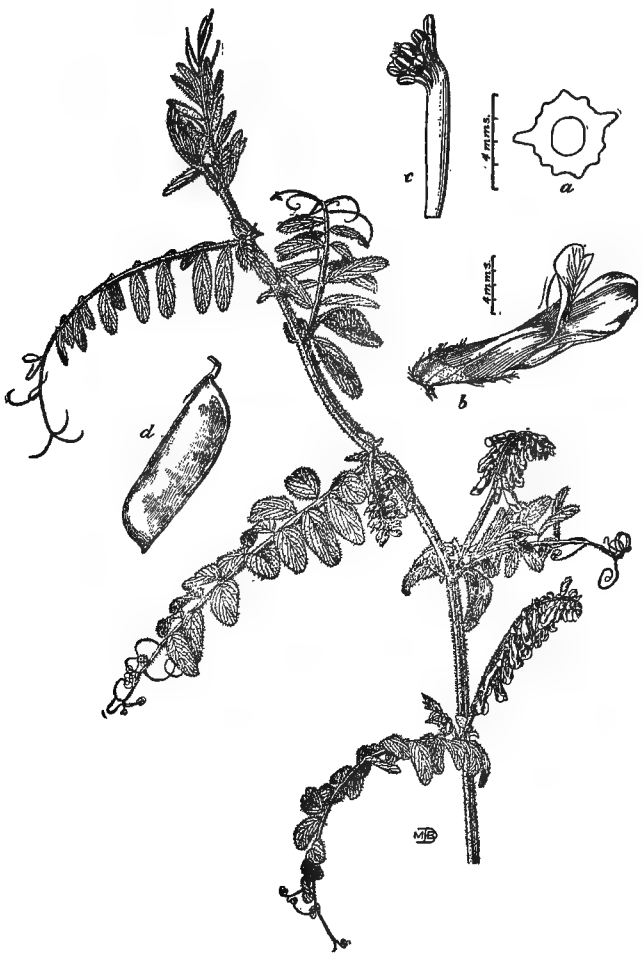


Fig. 122. Hairy vetch, *Vicia villosa*, showing also enlarged flower, column of stamens and pod. After Tracy, Bull. No. 15, Div. of Agrost. U. S. Dep. Agric.

fragrant sweet pea belongs to the genus *Lathyrus*, of which there are many wild species. *Vicia*, a closely related genus, includes the wild vetches and tares, so troublesome in grain fields, but it also contains the hairy vetch (*V. villosa*), an important forage plant of the southern States (see Fig. 122). The European genus *Lens* furnishes the lentil, while *Cicer* is the gram or chick pea.

Tribe Phaseoleae. This includes most of our cultivated beans, and a number of wild beans, the important genera being *Phaseolus*, *Canavalia* and *Glycine*. *Clitoria* and *Bradburya* furnish the "butterfly peas," very ornamental in cultivation, as are also the coral-red flowers of the tropical genus *Erythrina*. *Cajan Cajan* furnishes the pigeon pea of the West Indies and the Florida Keys. *Dolichos Lablab* is the familiar hyacinth bean.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXII.

Order Geraniales.

The large group Rosales, with which we have been dealing, was distinguished, it will be remembered, by the simple ovary, consisting either of one carpel or several separate and distinct carpels. In the order Geraniales the carpels are united, forming a compound ovary; the stamens are definite in number, rarely more than twice as many as the sepals; and the position of the ovule or immature seed in the ovary is also characteristic. The order is a large one, comprising 20 families, of which the most important are the Geraniaceae, Linaceae, Rutaceae, Burseraceae, Meliaceae, and Euphorbiaceae. The plants include herbs, shrubs and trees, many of which are of economic or ornamental value.

Fig. 123. The Alaskan cranesbill (*Geranium erianthum*) oue-half natural size. Original.

Family Geraniaceae. Geranium Family. Contains about 11 genera and 475 species, of rather wide distribution, but particularly abundant in South Africa. They are herbs with solitary or clustered flowers, which in *Geranium* and *Pelargonium* are often showy and bright colored. The stamens are 5 or a multiple of 5; the ovary 5-celled, becoming a capsule in fruit. The carpels, or divisions of the ovary, bear long tails which are often elastic when ripe, causing them to curl up. This has given the name "cranesbill "to the geraniums and their allies.

The most important genus is *Geranium*, represented in this country and in the Old World by numerous species, whose flowers range in size from those of the Carolina cranesbill (*G. Carolinianum*) and the herb Robert (*G. Robertianum*), to the large-flowered Alaskan species shown in Fig. 123. The cultivated geraniums belong mostly in the genus *Pelargonium*, distinguished by the somewhat irregular corolla. They have been wonderfully developed by long cultivation and hybridization. The genus *Erodium*, widely distributed in temperate regions of the Old World, is represented by three native species on the Pacific coast which frequently become bad weeds. They are known by the Spanish name of "alfilerilla."

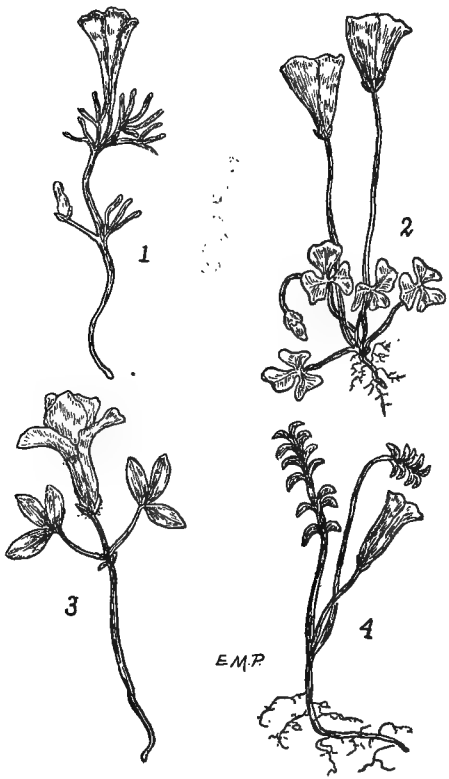


Fig. 124. Species of *Oxalis* or sorrel. 1. *O. versicolor*. 2. *O. commutata*. 3. *O. approximata*. 4. *O. hirta*. All one-half natural size. Original.

Family Oxalidaceae. Oxalis Family. Contains about 7 genera and 270 species, 250 of which are comprised in the single genus *Oxalis*. They are herbs of variable habit, or in a few instances shrubs. There is remarkable diversity in the leaves; while usually palmately 3-foliolate they are sometimes pinnate or even undivided and peltate (shield-shaped). The various shapes are shown in the four species of *Oxalis* represented in Fig. 124. The flowers are solitary or more often in forking cymes; sepals and petals 5, stamens 10-15; ovary 5-celled, usually capsular in fruit. The juice of the plants contains a sour principle due to oxalic acid. The various wild species of *Oxalis* are known as wood-sorrels; they have white, yellow or purple flowers. South Africa, particularly the Cape region, is the metropolis for these plants, and many varieties now in cultivation have come from there.

Family Tropaeolaceae. Tropaeolum Family. Consists of a single genus, *Tropaeolum*, including about 35 species, natives of the higher parts of Central and South America. They are herbs, erect or climbing by means of twisting leaf-stalks. The leaves are simple, and pel-

tate or palmately lobed or divided; the flowers, mostly large and showy, are quite irregular in structure, the calyx being prolonged into a nectar-bearing spur. The 5 petals are borne usually on long claws; stamens 5; ovary usually 3-celled, capsular in fruit (see Fig. 125, no. 1). It is *Tropaeolum majus* which is such a universal favorite in our gardens, and which commonly bears the name "Nasturtium." This is an inexcusable misnomer, for *Nasturtium* was known for years as the genus-name of the water-cress; and the fact that the latter is now known by another scientific name (*Rorippa*) does not excuse the misappellation of Nasturtium. The word Tropaeolum is easy to pronounce and to remember.

Family Linaceae. Flax Family. Includes 4 genera and about 150 species of wide geographic distribution in both temperate and tropical regions. The family is remarkable for the regularity and symmetry of its flowers, which have 4 or 5 sepals, 4 or 5 alternating petals, 4 or 5 stamens, and a 2-5-celled ovary (see Fig. 125 no. 2).

The genus *Linum* is a large one, containing numerous North American, south European and African species. While several are in garden cultivation, the only one of importance is the common flax (*L. usitatissimum*). This has been in cultivation since the earliest times, and is one of those plants that is not now known to occur in the wild state. Besides the use of the fiber from its stems in the manufacture of fine linen, the seeds, when soaked in water, yield a mucilaginous substance possessing medicinal properties, and when pulverized an oil known as linseed oil is expressed from them, the resulting oil-cakes being extensively used for fattening cattle.

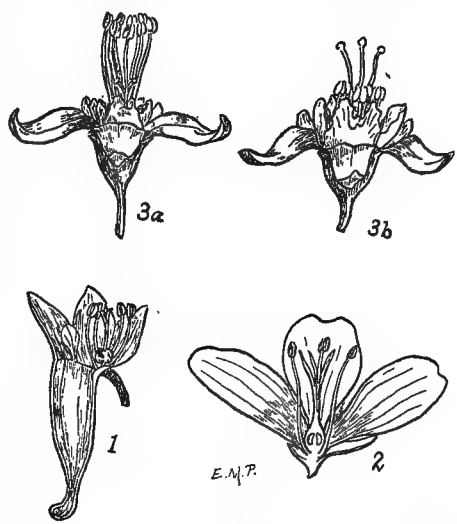


Fig. 125. Cross-sections of flowers; 1, *Tropaeolum pentaphyllum*. 2. Flax (*Linum usitatissimum*); 3a and 3b. Redwood (*Erythroxylon pulchrum*) showing two forms of stamens and pistils. All natural size. Redrawn from Engler.

Family Humiriaceae. Humiria Family. A group of South American trees comprised in 3 genera and about 20 species. *Humiria balsamifera* yields a reddish balsamic juice, which when dry is burned as an incense. A medicinal ointment is also prepared from it. The structure of the flowers in this family is similar to that of the Linaceae, but the fruit is a drupe instead of a capsule.

Family Erythroxylaceae. Redwood family. Contains two genera, *Erythroxylon*, with about 90 species, natives of South America and Africa, and *Aneulophus*, with a single species, *A. Africana*, a shrub of Upper Guinea. The plants are all shrubs or trees with small flowers, having 5 sepals and petals, and 10 stamens, the latter monadelphous, as we noted those of the Leguminosae to be. The fruit is a drupe containing a single seed. The bark, as the name indicates, contains a reddish coloring matter, from which a dye is prepared. The most interesting of the Erythroxylons is undoubtedly *E. Coca*, which yields the famous drug known as cocaine (Fig. 125 no. 3).

Family Zygophyllaceae. Caltrop or Bean-caper Family. Contains about 20 genera and 150 species, of wide distribution in warm and tropical regions. They are herbs, shrubs, or trees, with leaves mostly opposite and more or less divided. The flowers are perfect, with the parts chiefly in fives; ovary 4-12 celled, capsular or baccate in fruit.

Fig. 126. Creosote bush (*Covillea Mexicana*); flowering branch, one-half natural size. Original.

Several low herbs with pinnate leaves and yellow flowers, belonging to the related genera *Tribulus* and *Kallstroemia*, are common in the southwest, as is also the interesting creosote bush (*Covillea Mexicana*). So strong is the odor of the resinous principle in this plant, that I have known herbarium specimens many years old to cause a violent attack of hay-fever in a person subject to that disease. The shrub thrives in the desert region of Arizona and New Mexico and Mexico, and is very ornamental when in full bloom, although valueless either as fuel or for forage (see Fig. 126). The genus *Guiacum* consists of trees noted for the remarkable hardness of their wood, and for the resin which they contain. *G. officinale*, which is highly ornamental in cultivation, with its blue flowers and pinnate leaves, yields the heavy wood known as lignum-vitae. The leaves of *G. sanctum* are frequently used in the West Indies as a substitute for soap.

The seeds of several Old World shrubs or herbs belonging to this family, notably *Zygophyllum Fabago*, the bean caper, and *Peganum Harmala*, are used as vermifuges.

Family Cneoraceae. Cneorum Family. Contains the single genus *Cneorum*, comprising about 12 species of maritime shrubs in the Mediterranean region and in the Canary Islands. They have yellow flowers with 3-4 petals, 3-4 stamens, and a 3-4-lobed ovary. The fruit is pecu-

liar, consisting of 3 or 4 carpels which are fleshy without and hard or bony within. The plants have no economic and little ornamental value.

Family Rutaceae. Rue Family. Contains about 110 genera and nearly 900 species, most abundant in Australia and South Africa. They are trees or shrubs, rarely herbs, with strong-scented dotted herbage, opposite or alternate usually compound leaves, and usually cymose 4-parted flowers, the fruit a berry or a capsule. There are many exceptional characters, however, and the only reliable means of distinguishing the rueworts from allied families is by the glandular-dotted foliage.

The type of the family, *Ruta*, the rue, is a genus of herbs or undershrubs, frequently cultivated for the powerful volatile oil which they

Fig. 127. The southern prickly-ash (*Xanthoxylum Clava-Herculis*); showing fruit one-half natural size. Original.

contain, and which is used medicinally as a stimulant. In the same tribe is the highly ornamental herb *Dictamnus*, known as "fire-plant," from the fact that the oil given off by the herbage is so volatile as actually to become inflammable in hot weather.

The tribe to which *Boronia* belongs contains about 20 genera, exclusively Australian, many of them shrubs with pretty, heath-like flowers. Another tribe contains the prickly ash (*Xanthoxylum*), of which there are several species in the eastern United States (Fig. 127). The

berries are pungent and aromatic, and are sometimes chewed as a remedy for toothache. The trees of the Brazilian genus *Esenbeckia* have bark possessing bitter and tonic properties.

The orange and orange-like plants have frequently been classed as a distinct family, but are now usually included in the Rutaceae. There are numerous genera in this tribe, almost exclusively East Indian in origin, but frequently cultivated. All are distinguished by the familiar pulpy fruit. The orange, lemon, lime and shaddock all belong to the genus *Citrus*. Mention should be made of one other American rutaceous tree, the hop trefoil (*Ptelea*), distinguished by its trifoliate leaves and dry, winged fruit.

Family Simarubaceae. Ailanthus Family. Contains about 27 genera and 150 species, natives of tropical regions. They are trees or shrubs with bitter bark, distinguished from the preceding family mainly by the absence of dots on the foliage. The flowers are regular, either perfect or dioecious, 3-5-parted, the petals borne on a disk. The fruit is various.

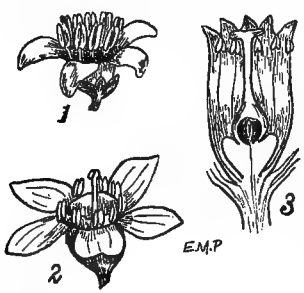


Fig. 128. Cross-section of flowers, enlarged. 1. Quassia (*Simarouba officinalis*). 2. *Boswellia Carteri*. 3. Mahogany (*Swietenia Mahogoni*). Redrawn from Engler.

Our only North American representatives of this family are the ailanthus or "tree-of-heaven," a well-known shade tree extensively naturalized from Asia, and an indigenous species of *Simarouba*, on the Keys of south Florida. Various South American species of the genus yield valuable medicines. Quassia is the product of several trees belonging to this family, but is principally derived from *Simarouba amara* (Fig. 128, no. 1).

Family Burseraceae. Terebinth Family. Contains 16 genera and about 300 species, natives exclusively of tropical Asia, Africa and America. They are forest trees of high value as resin and balsam bearing plants. Thus myrrh is the product of *Commiphora Abyssinica*, and bdellium is derived from *C. Africana*. The resin known as olibanum, which is supposed to have been the frankincense of the ancients, comes from the Arabian *Boswellia Carteri*. Various gums are yielded by *Bursera*, the only genus which penetrates the Florida peninsula. The fruits of *Canarium* are edible. The Burseraceae as a whole have no good characters distinguishing them from the two preceding families, except that the husk of the fruit splits into valve-like segments. A section of the flower of *Boswellia Carteri*, showing structure, is seen in Fig. 128, no. 2.

Family Meliaceae. Melia Family. Contains about 40 genera and 200 species. They are trees or shrubs differing from most of the fam-

ilies already discussed in having leaves without stipules.* The sepals and petals are 4 or 5; the stamens, equal in number or more numerous, are commonly united in a tube. The fruit is a berry, a drupe or a capsule. Like the Simarubaceae, most of the trees of this family have bark possessing bitter and tonic properties. The "pride-of-India" or chinaberry tree (*Melia Azederach*) is extensively cultivated in the South as a shade tree, and has now become thoroughly naturalized; it has enormous pinnate leaves and large panicles of pink flowers succeeded

Fig. 129. *Byrsonima lucida*, natural size. Original.

by small straw-colored berries. The tropical genera *Trichilia* and *Carapa* yield useful oils. *Swietenia Mahogoni* is the source of mahogany (Fig. 128, no. 3).

Family Malpighiaceae. Malpighia Family. Contains about 50 genera and 600 species, natives mainly of tropical America. They are trees or shrubs with opposite stipule-bearing leaves and regular flowers borne on jointed pedicels. Calyx 5-parted; petals 5, usually long-clawed; stamens 10, inserted with the petals on a disk; ovary 3-lobed,

* A stipule is the small leaf-like body borne at the base of an ordinary leaf.

fleshy or capsular in fruit; the carpels often very curiously and prominently winged. The fruit of *Malpighia glabra* is edible, being known in the West Indies as the Barbadoes cherry. Other species of this genus are cultivated for their peculiar flowers, as also species of *Banisteria* and *Hiraea*. This family is represented in the United States by five genera, one member of which is the undershrub *Byrsonimia lucida*, occurring in south Florida. It has racemes of rather pretty pink flowers. *B. spicata* of the West Indies has edible acid berries and bark used for medicinal purposes and for tanning.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS

By Charles Louis Pollard.

CHAPTER XXII.—*Continued.*

Family Trigoniaceae. Trigonia Family. A small group of South American trees consisting of two genera, *Trigonia*, with 26 species, and *Lightia*, with two. The plants are most anomalous in structure, and have given botanists much trouble to dispose of them properly in the systematic sequence. The flowers are very irregular, one petal being much larger than the remaining four, and placed uppermost, like the banner petal in a papilionaceous flower. One of the petals is spurred somewhat like a violet; the stamens are united in two series.

Family Vochisiaceae. Vochy Family. Contains 7 genera and about 130 species, exclusively South American. They are trees or shrubs with opposite leaves and very showy yellow, white, pink or purple flowers in large terminal racemes or panicles. The flowers are irregular, having 4 to 5 sepals, an equal number of petals, and few stamens, sometimes reduced to one; the ovary is 3-celled, becoming a winged fruit or capsule. *Vochisia* and *Qualea* are often cultivated for their beautiful flowers, and the trees frequently yield valuable timber, the well-known copaiyé wood of Guiana being the product of *Vochisia Guianensis*. A yellow dye is also obtained from certain species of *Qualea*. The popular name which I have adopted for the family is derived from the native name of some of the trees in Guiana.

Family Tremandraceae. Tremandra Family. Two genera, *Tremandra* and *Platytheca*, the former with two species, the latter with one, all confined to West Australia. They are heath-like shrubs with red, blue or white slender-pedicelled flowers; the latter are regular, with 4-5 sepals, 4-5 petals, 8-10 stamens, and a 2-celled ovary.

Family Polygalaceae. Milkwort Family. These plants are herbs, rarely shrubs or small trees, comprised in about 10 genera and 750 species, widely distributed in both temperate and tropical regions. *Polygala* is the most important genus, consisting of over 250 species, a fifth of which are found in the United States. The plants are of interest to the botanist on account of the somewhat singular structure of

their flowers; there are 5 sepals, the two lateral ones much larger than the others, often brightly colored, and known as *wings;* the petals are 3 or 5, somewhat united at their bases, the lowermost one often crested; stamens 8, monadelphous or diadelphous (united in one or two sets); ovary 2-celled, capsular in fruit, the seeds with a wart or protuberance called a *caruncle.* The flowers vary greatly in color and in the mode of arrangement, being white, yellow or purple, borne in close heads, in spikes, racemes or cymes, the latter a spreading, flat-topped form of inflorescence.

In the northern States the milkworts are mostly small, inconspicuous plants, an exception being noted, however, in the case of the beautiful little fringed polygala (*P. paucifolia*), often known as flowering wintergreen. This has leaves like the true wintergreen, with rose-purple, beautifully fringed flowers. It also produces subterranean flowers without petals, and these yield most of the fruits. In the South, particularly throughout the pine barrens, the milkworts are among the most conspicuous of the flowering plants, large masses of various species being constantly met with. Among the more handsome forms should be noted the various yellow flowered species (*P. cymosa, P. ramosa,* and *P. lutea*), and the large purple flowered *P. grandiflora* (see Fig. 130).

Fig. 130. Large-flowered milkwort (*Polygala grandiflora*), one-half natural size. Original.

Family Dichapetalaceae. Dichapetalum Family. Consists of 3 genera and about 80 species, widely distributed in the tropics, and particularly abundant in Africa and Madagascar. They are trees or shrubs with small flowers, similar in general structure to those of the following family.

Family Euphorbiaceae. Spurge Family. Contains about 210 genera and 4000 species, of wide distribution. They are herbs, shrubs or trees; with monoecious or dioecious flowers, and an acid, often milky, and frequently poisonous juice. The flowers are usually without petals, and sometimes, as in *Euphorbia,* without a calyx, the latter being replaced by an involucre or whorl of leaves resembling a calyx. The stamens vary greatly among the different genera; the ovary is usually 3-celled, with 3 styles, and the fruit a 3-lobed capsule; the latter generally serves as an easy means of identifying any member of the family.

The Euphorbiaceae are of interest in many ways; and following the practice previously adopted in these pages, we shall discuss the important genera in the order of their tribal relationship.

Phyllanthus (leaf flower) is a large tropical genus, named from the circumstance that the flowers in some of its species are borne on leaf-like, flattened branches called *phyllocladia.* Though the genus contains over 400 species, none are of any economic importance. Many are weeds of waste places in the tropics.

The genus *Croton* is represented in our country by numerous rank weeds in the South and West, often called goatweeds. The herbage in most of the species is covered with stellate hairs, giving the plants a silvery or even woolly appearance. The so-callod crotons of cultivation belong tn an entirely different genus (*Codiaeum*). The most important member of the genus is *C. Tiglium,* native of the East Indian archipelago, the seeds of which yield croton oil, a powerful purgative. Many species possess tonic and aromatic properties, like the West Indian *C. Eluteria,* from which cascarilla bark is obtained. *C. bacciferum* and *C. Draco* yield a resin used in varnish-making.

The tribe Acalypheae includes a number of genera, *Acalypha,* the type, containing the now familiar "chenille plant" of cultivation, with long drooping crimson spikes of staminate flowers. The stringwood of the island of St. Helena, now known to be quite extinct, was *A. rubra. Mallotus Philippinensis,* a tree of the Polynesian and Philippine regions, bears capsules covered with a red powder, from which is obtained a brilliant orange dye well known in India by the name *Kamala.* The genus *Tragia,* with several American species, has stinging hairs like those of nettles, which the plants strongly resemble. The castor oil bean (*Ricinus communis*) is too familiar an object in cultivation to require description. Its highly ornamental seeds are susceptible of a fine polish.

In the tribe Jatropheae we have the genus *Jatropha,* several species of which yield medicinal oils, also *Aleurites Moluccana,* the candleberry tree of the South Pacific islands. The seeds of this tree burn with great freedom on account of their large percentage of oil. They are also used as an article of food.

To the native in South America, manioc or cassava is as important as wheat to the northerner, as it forms his staple diet. Various species of *Manihot* yield cassava, which is obtained by grinding or pounding the root after the poisonous juice which it contains has been expelled by pressure.

The tribe Hippomaneae contains the West Indian manchineel (*Hippomane Mancinella*) one of the most poisonous trees of the family; also the sandbox tree (*Hura crepitans*), the explosive property of whose fruits has been so often described.

Finally, there is the genus *Euphorbia,* the type of the family, embracing about 600 species, distributed in all parts of the world. They

are herbs or shrubs, in some regions leafless and fleshy, like cacti, which they replace in the deserts of the Old World. Our species are mostly herbs of weedy aspect. They frequently have the upper leaves and bracts brilliantly colored, as in the familiar poinsettia, which is a Euphorbia. *E. marginata*, represented in Fig. 131, belongs to this class.

Fig. 131. The white-margined spurge (*Euphorbia marginata*). Original.

The milky juice which is found in members of this genus possesses important medicinal properties. It is also very poisonous when taken internally, though the poisonous principle may be dissipated by the action of heat. A fair article of caoutchouc is made from the juice of an East Indian species.

Family Callitrichaceae. Water Starwort Family. These are

small aquatic or sometimes terrestrial herbs, comprised in the single genus *Callitriche*, which contains about 20 widely distributed species. They have slender stems, opposite leaves, and minute perfect or monoecious axillary flowers, destitute of calyx and corolla; stamen one, ovary 4-celled, becoming a capsular fruit which splits into 4 little one-seeded carpels. The plants are inconspicuous, and without special interest.

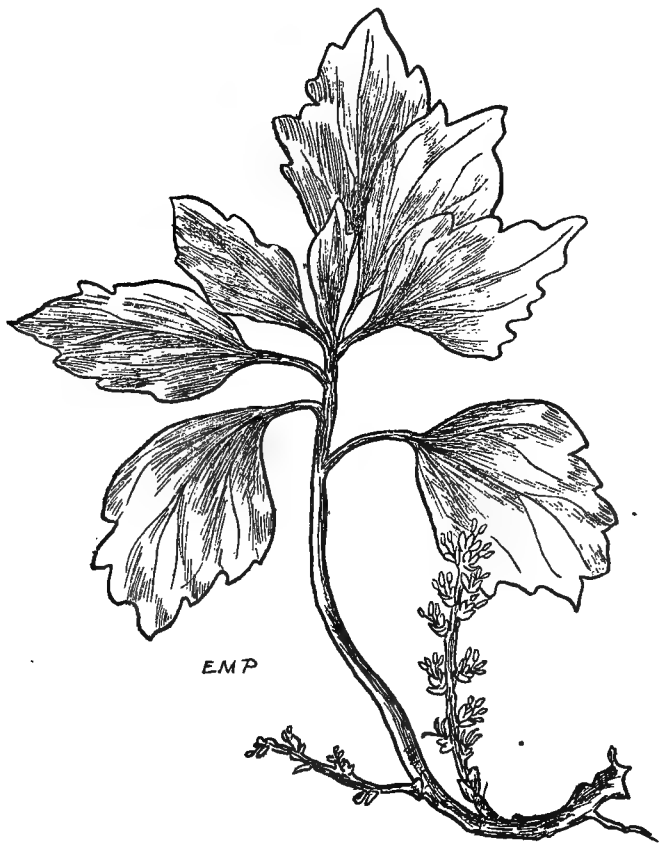


Fig. 132. Allegheny Mountain spurge (*Pachysandra procumbens*). Original.

CHAPTER XXIII.

Order Sapindales.

This order is essentially similar to the Geraniales, although there are important differences in the structure of the seed. The families comprised in it must therefore be learned by experience. There are 20 of these, the most important being the Anacardiaceae, Aquifoliaceae, Celastraceae, Aceraceae, Hippocastanaceae, and Sapindaceae.

Family Buxaceae. Box Family. This was formerly united with the Spurge Family above described, from which it may be distinguished by the absence of milky juice. There are 6 genera and 30 species; the familiar evergreen known as box is *Buxus sempervirens*, a member of the typical genus. In the Allegheny mountains grows a curious herb, the Allegheny mountain spurge (see Fig. 132), which also belongs to the family; the spikes of staminate flowers are quite fragrant. The only other known species of *Pachysandra* is Japanese, the genus thus affording another instance of that curious analogy between the Japanese and the eastern North American flora.

Fig. 133. The crowberry (*Empetrum nigrum*). Original.

Family Empetraceae. Crowberry Family. These are low, evergreen shrubs of heath-like aspect, with small axillary or clustered dioecious flowers succeeded by berry-like drupes. Sepals 3, petals 2 or 3 or wanting; stamens usually 3. There are only three genera, *Empetrum*, *Corema* and *Corrigiola*. High up in the arctic regions, extending southward to our northern border, grows the crowberry (see Fig. 133), covering dense patches of ground, its black berries affording an abundance of food for the Arctic birds. Another species is found in Antarctic South America. Scarcely less remarkable is the distribution of *Corema*, one species of which (*C. Conradii*) occurs in a few isolated stations from Newfoundland to New Jersey, the other in southwestern Europe. The third member of this family, *Corrigiola*, is a monotypic genus of Florida.

Family Coriariaceae. Coriaria Family. Consists of the single genus *Coriaria*, with 8 species, natives principally of the Old World, although one species occurs in Peru. They are shrubs with ribbed leaves and clusters of flowers having the parts in fives. The fruit consists of 5 one-seeded carpels, surrounded by the persistent fleshy petals. The fruit of the common European species (*C. myrtifolia*) is poisonous, but some of the Oriental forms have edible fruits, though the seeds are usually poisonous.

Family Limnanthaceae. False Mermaid Family. These are delicate annual herbs of two genera. One, *Limnanthes*, is confined to the Pacific States, and contains about 6 species; the other, *Floerkea*, is a marsh plant rather widely distributed through the United States. The family is distinguished by the alternate, pinnately divided leaves, and

by the perfect flowers, which bear glands alternating with the petals; stamens twice as many as the petals; fruit capsular, the carpels nearly distinct. The delicate flowers of *Limnanthes Douglasii* are sometimes seen in cultivation, but the family is of slight importance.

Family Anacardiaceae. Cashew Family. The trees and shrubs comprising this family may nearly always be recognized by the milky, often caustic juice, inconspicuous flowers, and ovary containing a single ovule; the leaves, moreover, are without glands or dots. There are

Fig. 134. The poison sumach (*Rhus Vernix*). After Britton & Brown, Ill. Fl. Northeast. U. S.

about 50 genera and 400 species, most abundant in tropical regions. In our own area the family is represented by the sumachs (*Rhus*), some species of which are quite harmless and extremely ornamental, while others are highly poisonous. The poison oak (*R. Vernix*) or swamp sumach is the most virulent of these, while the common poison ivy (*R. radicans*) is dangerous to many people. The researches of specialists during the last few years have shown that the poisonous principle resides in a volatile oil which occurs in all parts of the plant; also that the best remedy is a solution of acetate of lead.

In the tropics there are a number of important economic trees belonging to this family. The fruits of *Anacardium occidentale*, known as cashew nuts, are edible after the acridity has been removed by roast-

Fig. 135. The poison ivy (*Rhus radicans*). After Britton & Brown, Ill. Fl. Northeast. U. S.

ing. Pistache nuts are the product of a species of *Pistacia*, native of western Asia. The mango, that most delicious of tropical fruits, is yielded by *Mangifera Indica*, a handsome tree with deep green foliage. The odor of turpentine so noticeable in the outer skin of the mango is significant of a property common to nearly all Anacardiaceous trees, and a great variety of varnishes, resins and the like are obtained from them.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS

By Charles Louis Pollard.

CHAPTER XXIII.—*Continued.*

Family Cyrillaceae. Cyrilla Family. This consists of two small trees, *Cliftonia* and *Cyrilla*, both natives of the southern United States, and a genus of tropical American shrubs, *Costaea*, with 3 species. The two first-named genera are probably both monotypic, although a second species of *Cyrilla* has been described. They are both highly ornamental, having long racemes of white, holly-like flowers. The family is indeed very closely related to the Holly Family, but differs in the fruit, which is sometimes winged.

Family Pentaphylacaceae. Pentaphylax Family. Contains the single genus *Pentaphylax*, with one species, an East Asiatic tree.

Family Corynocarpaceae. Corynocarpus Family. Also monotypic, containing the New Zealand *Corynocarpus laevigatus*. The latter is a very handsome tree with deep green foliage and small white flowers in terminal clusters. The tree is said to be valued for its fruit, which resembles a plum in appearance and taste. The seeds are poisonous when raw, but after cooking, an edible farinaceous substance is extracted from them.

Family Aquifoliaceae. Holly Family. Contains five genera and about 175 species, natives of both temperate and tropical regions. *Ilex* is the only important and by far the largest genus, containing over 160 species. This family is characterized by the usually dioecious flowers, which are regular in structure, having a 3-6-parted calyx, and corolla of 4-6, sometimes united petals (see Fig. 136). On the latter account the family has often been placed over among the gamopetalous plants, or those having the corolla in a single piece; but the joining is not very complete, appearing more like simple cohesion. The fruit is a small berry-like drupe, red, blue, or black in color, and familiar to us as the "holly berry" of Christmas-tide.

The English or European holly (*Ilex Aquifolium*) has more glossy deeper green foliage than our American holly (*I. opaca*), and hence is imported to a considerable extent for decorative purposes. There are

about a dozen other species of *Ilex* in the United States, some with deciduous and some with evergreen leaves, but none of them are very ornamental except possibly when loaded with ripe fruit. The leaves of the "yaupon" in the Southern States (*I. Cassine*) have been used for tea; but it is from the leaves of *I. Paraguayensis*, a South American species, that a beverage of really fine quality is obtained. It is known as maté or Paraguay tea, and is as important in the commerce of the country as ordinary tea is in China, the annual consumption reaching 8,000,000 pounds. The beverage is very stimulating, and when taken in excess is almost an intoxicant. The leaves of several other South American species are used for the same purpose.

Family Celastraceae. Staff-tree Family. Consists of about 40 genera and 350 species, of wide distribution, though chiefly in warm regions. They are trees or shrubs, frequently climbing, with simple leaves and small regular perfect flowers, with a conspicuous disk in the center, on which are situated the stamens and petals, which are both 4 or 5 in number, alternate with each other. The ovary is 3-5-celled, becoming in fruit either a capsule or a somewhat fleshy pod having much the appearance of a berry, the seeds with an appendage known as an *aril*. This is often brilliantly colored, whence the name of "burning bush," applied to our American species of *Euonymus*, one of which is shown in Fig. 137. The climbing false bittersweet (*Celastrus scandens*) is a familiar object in the fall, with its bright yellow fruits and red-arilled seeds. In Fig. 136 is seen a section through the fruit of *Wimmeria*, a tropical shrub belonging to this family.

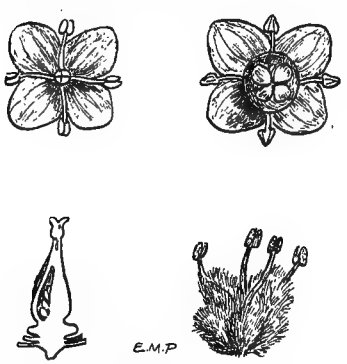


Fig. 136. The two uppermost drawings, male and female flowers of European holly. Lower left hand, capsule of *Wimmeria;* lower right hand, flower of *Phytocrene.* Redrawn from Engler.

The Celastraceae possess no very important economic feature. The Arabian *Catha edulis* furnishes from its dried leaves a beverage known as kat-tea or cafta, the flavor of which is pleasing. The Arabs also believe that a twig of the bush worn in the bosom prevents the person from danger of infection. The herbage of *Euonymus* is poisonous.

Family Hippocrateaceae. Hippocratea Family. Contains *Hippocratea*, with about 60 species, and *Salacia*, with about 70. Both are tropical shrubs or trees, distinguished from the preceding family by having flowers with 3 monadelphous stamens and 5 petals. The fruit is sometimes edible. *Hippocratea ovata*, a climbing shrub, is the sole

representative of the family in the United States, occurring in the Everglades of Florida.

Family Stackhousiaceae. Stackhousia Family. Consists of a single genus, with about 20 species, all herbs, natives of Australia and New Zealand. They have flowers with unequal stamens, and with the petals slightly united into a tube, but possess no features of especial interest.

Family Staphyleaceae. Bladdernut Family. Trees and shrubs, comprised in 5 genera and about 25 species, widely distributed. They have the leaves pinnate or in threes, with regular perfect flowers in axillary or terminal clusters, the parts in fives. The interesting structural character is found in the fruit, which is an inflated capsule in *Staphylea*, the bladdernut, a rather ornamental shrub, having creamy flowers and curious bladdery pods (see Fig. 138).

Family Icacinaceae. Icaco Family. Contains about 40 genera and nearly 100 species, tropical trees or shrubs. They are close in structure to the Aquifoliaceae, but are often remarkable for the woolly flowers, one of which, of the genus *Phytocrene*, is shown in Fig. 136. The South American *Villaresia Congonha*, belonging to this family, yields a tea similar to the true maté described above.

Family Aceraceae. Maple Family. Consists of *Acer*, the maples, with about 100 species, and *Dipteronia*, a monotypic genus of Asia, which differs in having the fruits winged on the whole circumference.

Fig. 137. The American spindle-bush (*Euonymus Americanus*). Original.

The maples are a most interesting group of trees, and the different species have a very marked individuality. They are grouped according to the flowers, which may be in dense axillary clusters, like those of the red, or soft, and silver maples, which open before the leaves; in lateral flat-topped clusters or corymbs, often drooping, like those of the sugar maple, which open with the leaves; or they may be in long spikes or racemes opening after the leaves, as in the striped maple (see Fig. 139). The petals are 5 in number, or wanting in some species; the sta-

mens are 4-12; and the 2-lobed ovary becomes in fruit a familiar "key" or *samara*, differing greatly in shape. Maple wood is hard, of variable density and color; it is ordinarily susceptible of a fine polish, and plays an important part in cabinet making.

Family Hippocastanaceae. Horse-chestnut Family. Contains two genera, *Æsculus*, with about 15 species, and *Billia*, with 2, the latter Mexican. They are trees or shrubs with palmately divided leaves and perfect, irregular flowers borne in large pyramidal panicles. The calyx is bell-shaped; petals 4 or 5, long-clawed; stamens 5-8; ovary 3-celled, becoming a leathery capsule containing 1-3 large shining seeds.

The common horse-chestnut (*Æ. Hippocastanum*) of our streets and parks is a native of Asia, but has escaped from cultivation in many places in the East. The western buckeye (*Æ. glabra*) is well shown in the accompanying photograph (Fig. 140.) There are several other ornamental native species, some with red and some with yellow flowers.

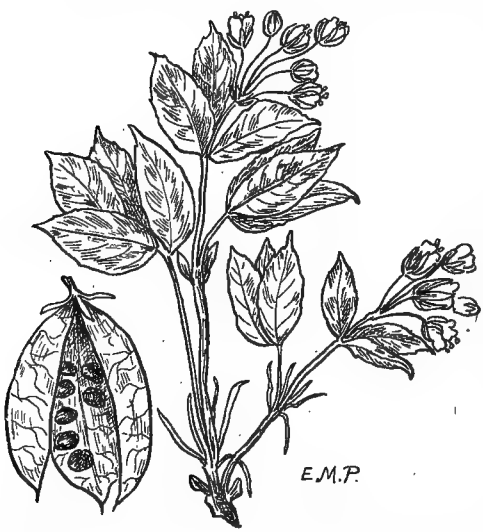


Fig. 138. The bladder-nut (*Staphylea trifolia*) showing flowering branch and detached fruit. Original.

Family Sapindaceae. Soapberry Family. Contains about 120 genera and over 1000 species, of wide distribution in tropical and semitropical regions. They are trees or shrubs with mostly pinnate or palmate leaves, and regular or irregular, perfect or sometimes dioecious flowers. Calyx 4-5 lobed or divided; petals 3-5, borne on a fleshy disk, as are the 5-10 stamens; fruit a berry or a capsule, the latter sometimes bladdery-inflated, as in the balloon vine (*Cardiospermum*) of our gardens.

Sapindus is a genus of about 10 species, one or two of which are found within our borders. They are called soapberries, from the fact that the outer covering of the fruit contains a saponaceous principle used extensively in the tropics in place of ordinary soap. The hard round seeds of some species are used for making necklaces and rosaries. *Serjania* and *Paullinia* are two very large genera of climbing shrubs, common in tropical regions. The seeds of *P. sorbilis*, the guarana, are made into compressed cakes from which a cooling beverage is prepared, and form an extensive article of trade in Brazil. Litchi nuts,

Fig. 140. Buckeye (*Æsculus glabra*). After photograph by Carl Krebs.

which are sold among the Chinese in our large cities, are the product of *Litchi Chinensis*. *Blighia sapida*, a West African tree, also furnishes edible fruit.

Family Sabiaceae. Sabia Family. Four genera and about 65 species, tropical trees and shrubs of no special interest.

Family Melianthaceae. Melianthus Family. Two genera and about 15 species, also tropical.

Family Balsaminaceae. Balsam Family. Contains the genus *Impatiens*, with about 220 species, mostly natives of the Old World, and *Hydrocero*, with one, the latter a native of India. The balsams or jewel-weeds, as we call them, are succulent herbs, with alternate single leaves and showy, very irregular flowers. Sepals 3, the two lateral ones small and green, the other large and sac-shaped, spurred, and colored like the corolla; petals 5, 3 of them cleft; stamens 5; fruit in *Impatiens* a capsule, in *Hydrocera* a berry.

We have two jewel-weeds, the pale and the spotted (see Fig. 141). The flowers are dainty little things, quite in keeping with the cool, shaded swamps or brooksides where the plants usually abound. Other species are cultivated in our gardens.

Fig. 139. The striped maple (*Acer Pennsylvanicum*). After Britton & Brown, Ill. Fl. Northeast. U. S.

Family Rhamnaceae. Buckthorn Family. Contains about 45 genera and 575 species, widely distributed in temperate and tropical regions. They are shrubs or small trees, sometimes thorny, with small, clustered, regular flowers. Calyx 4-5-toothed; petals 4-5, inserted on the throat of the calyx, or sometimes wanting; stamens 4-5; ovary 2-5-celled, becoming in fruit a small drupe or a capsule.

Rhamnus, the buckthorn, occurs in both Europe and America, and several species may be classed as ornamental trees, the dark green foliage being usually very handsome. The fruits of *R. catharticus* were formerly in some demand as a purgatfve; various pigments are derived from the fruits of this and other species. On the Pacific coast one of the conspicuous shrubs is the California lilac (*Ceanothus thyrsiflorus*), which has bluish flowers somewhat resembling those of the lilac. There are over 30 other species of this genus through California and Mexico. One of the few eastern species, *C. Americanus*, is known as

Fig. 141. The pale touch-me-not (*Impatiens aurea*). After Britton & Brown, Ill. Fl. Northeast. U. S.

New Jersey tea, from the fact that the leaves were used as tea by the troops during the Revolution.

The fruits of various species of *Zizyphus* are largely eaten in the Orient, particularly those of the jujube (*Z. Jujuba*).

Some of the woody climbers belonging to this family are responsible in the tropics for the impenetrable jungle of vegetable ropes or lianas which must be cut apart before a path can be made. In the West Indies and on the Florida Keys, *Gouania Domingensis* is an example. The photograph (Fig. 142) shows the clusters of small flowers and the tendrils by which the plant climbs. Throughout our Southern States the supplejack (*Berchemia volubilis*) is conspicuous in swamps, its slender rope-like stems possessing a wonderful degree of tenacity.

Fig. 142. Branch of chew stick (*Gouania Domingensis*), showing flower-spikes and tendrils. After photograph by G. N. Collins.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS

By Charles Louis Pollard.

CHAPTER XXIII.—*Continued.*

Characterization of the order Rhamnales was accidentally omitted from the last installment of the Supplement. It consists only of the two families Rhamnaceae and Vitaceae—the buckthorns and the grapes. Both are distinguished from the preceding group of families (comprising the order Sapindales) by having the stamens opposite instead of alternate with the petals.

Fig. 143. The wine grape of Europe (*Vitis vinifera*). Original.

Family Vitaceae. Grape Family. Consists of 10 genera and about 450 species, of wide distribution. Though not very large, containing only about 40 species, the genus *Vitis* is the most important from an economic standpoint. The common grape of Europe (*Vitis vinifera*), is among the most ancient of cultivated fruits. Vineyards are frequently mentioned in the Bible, and the references date back even to the flood: "Noah began to be an husbandman, and he planted a vineyard." Yet it is a remarkable fact that although southern Europe is the headquarters for cultivation of the vine, there is no single indigenous species on the

Continent. *V. vinifera* is native of the eastern and southern shores of the Caspian and the Black seas, and a number of species occur throughout India, China and Japan. In North America the species belong to distinct groups. The fox-grapes are characterized by dense clusters of fruit having a soft pulp and a strong, musky flavor. *V. Labrusca,* an example of this class, is our commonest northeastern species. In cultivation it gives rise to those excellent varieties of hardy grapes known as the Concord, Isabella and Catawba. The muscadine, or bullace grapes, constitute another type, represented in the Southern States by *V. rotundifolia;* this has nearly orbicular leaves, without lobes and the berries are solitary or few. The famous "scuppernong" of the South is derived from this species; its fruit, with a plum-like pulp, is excelled by no other grape unless it be by the Tokay of California.

Fig. 144. Fruiting branch of *Sloanea quadrivalvis*, a tree of the Elaeocarpus Family. Original.

Grape cultivation in Europe is almost entirely for the production of wine, the annual consumption of which, particularly in the Old World, reaches enormous proportions. In western Asia Minor grapes are grown largely for drying, in which condition they are familiarly known as raisins. Cooking currants, so-called, are not true currants, but small seedless raisins of a more acid variety.

The Vitaceae, which were formerly called Ampelidaceae,

Fig. 145. One of the jute plants (*Corchorus olitorius*) showing leaves, flower and fruit. Original.

may be distinguished very easily. They are climbing or erect shrubs with alternate leaves and watery juice. The small greenish flowers are either perfect or dioecious, and are borne in variously shaped clusters. The petals are 4-5, and fall soon after the flower expands. When tendrils are present they are borne apparently opposite the upper leaves, the inflorescence being opposite the lower leaves as shown in Fig. 143. These tendrils, however, are technically regarded as abortive shoots.

The Virginia creeper (*Parthenocissus quinquefolia*) is another member of the family, as also the Japanese ivy (*P. tricuspidata*). The very large genus *Cissus* is widely represented in tropical Asia.

Fig. 146. *Grewia orientalis* showing flowering branch and enlarged flower. Original.

Fig. 147. Flower of *Hibiscus schizopetalus* showing the monadelphous stamens. Drawn from a photograph by Mr. G. N. Collins.

CHAPTER XXIV.

Order Malvales.

This very distinct order contains eight families, the most important being the Malvaceae or Mallow Family and the Tiliaceae or Linden Family. Like the preceding order they are distinguished mainly by floral characters. The sepals are called by botanists *valvate*, which means that in the bud before unfolding their edges just meet without overlapping, in which case they would have been *imbricated*. The valvate sepals may be easily observed in the flower of any common mallow. The ovule-bearing walls within the ovary are

also united in the center throughout the order.

Family Elaeocarpaceae. Elaeocarpus Family. Contains 7 genera and about 120 species, which formerly constituted one or more sections of the Linden Family (Tiliaceae), from which they may be distinguished by the fringed or laciniate petals. The plants are shrubs or trees, native of the tropics of both hemispheres. *Elaeocarpus*, named for the resemblance which its fruit bears to an olive, contains about 60 species, some of which are valuable timber trees. The pulp of the fruit is edible, and the seeds are polished and sold as ornaments. *Sloanea*, another large genus, has hard capsular fruits, splitting into four or five valves; a fruiting branch of *S. quadrivalvis* is shown in Fig. 144. The wood of *S. Jamaicensis* is known as ironwood, or breakaxe.

Fig. 148. Flower and fruit of the cotton plant (*Gossypium herbaceum*). After Dodge, Report No 9, U. S. Dep't of Agric.

Family Chlaenaceae. Thickleaf family. Trees or shrubs comprised in 7 genera and about 20 species, of somewhat peculiar interest from the fact that the whole family is confined to the island of Madagascar. They are trees or shrubs, with leathery, spirally arranged leaves, and flowers produced from a sort of cup or involucre.

Family Gonystylaceae. Gonystylus family. Consists of the single genus *Gonystylus*, with 7 species of Asiatic trees.

Family Tiliaceae. Linden Family. Contains about 35 genera and 250 species, of wide distribution in warm or tropical regions, comparatively few in the temperate zones. They are chiefly trees or shrubs, having simple, usually alternate leaves, and clustered flowers. The calyx has 5 sepals; the petals are of the same number, or sometimes

fewer, rarely entirely absent; stamens numerous, united in several sets; ovary 2-10-celled, becoming a berry a drupe or a capsule in fruit. The Linden family is represented in our region almost exclusively by the linden proper (*Tilia*), of which there are several species in America and Europe. The tree may always be recognized, when in bloom, by the fragrant clusters of white flowers, the peduncles of which are partly coherent with, in fact seeming to spring from, a broad membranous bract. At other seasons the broad, cordate leaves are characteristic.

Fig. 149. Flowers, section of fruit, column of stamens, and seeds of the swamp rose mallow (*Hiblscus moscheutos*). After Dodge, Report No. 9, U. S. Dep't of Agric.

Lindens or basswoods are not only useful as shade trees, but they yield wood of fine quality, and the flowers provide a favorite food for bees. The inner bark is tough and fibrous, and in Russia forms an extensive article of commerce under the name of Russia matting, being used for tying, packing, etc. But it is the genus *Corchorus* that is of the most value in this respect, for several species of the latter yield jute, one of the most valuable of our fibers. One of the jute plants, an East Indian species (*C. olitorius*) is shown in Fig. 145. All the members of this genus are herbs. *Grewia* and *Triumfetta* are other types of the Linden

family, consisting of tropical trees, most of which yield useful fiber and good timber (see Fig. 146).

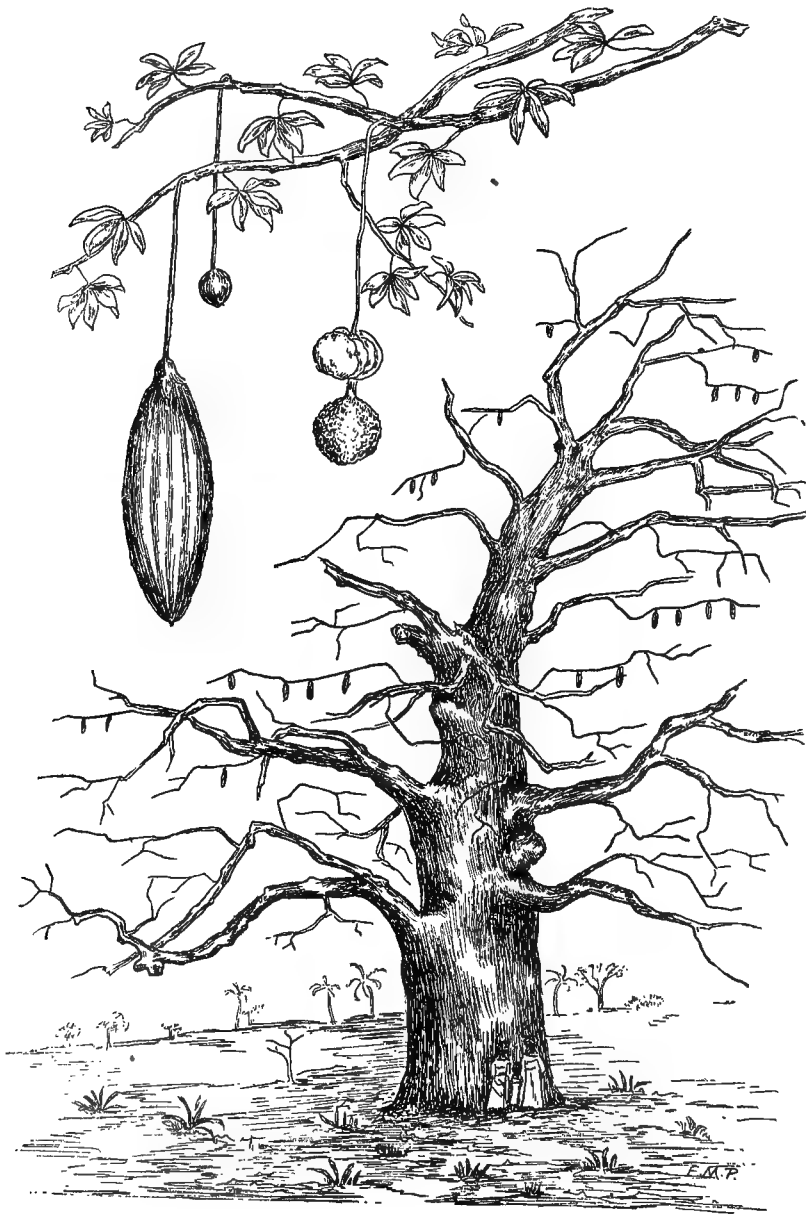


Fig. 150. Baobab tree (*Adansonia digitata*), the upper corner showing a branch bearing flowers and fruit. Redrawn from Engler.

Family Malvaceae. Mallow Family. Contains about 40 genera and 800 species, of wide distribution in both tropical and temperate regions. The mallows are herbs or shrubs, rarely trees, with mostly palmately-veined leaves and large flowers. The calyx, of 5 sepals, is often surrounded by leafy bracts at the base. The petals are 5; stamens numerous and always characteristic of the family on account of their union by the filaments into a single column closely surrounding the pistil, when they are said to be *monadelphous;* this column is well shown in the flower represented by Fig. 147. The ovary

Fig. 151. Flowers and fruit of the chocolate tree (*Theobroma Cacao*). Redrawn from Engler.

is several-celled, and the fruit is usually a capsule of several carpels. The mallow family as a whole possesses mucilaginous juice, and also yields fibers of more or less value. Cotton is the product of various species of *Gossypium.* It consists of the tuft of fine hairsattached to the seed, and known technically as the coma. One or two species of wild cotton are found in the extreme southern part of our country, but the commercial product is derived from species of exotic origin (see Fig. 148). One of the largest genera is *Hibiscus,* which furnishes us with such ornamental plants as the garden hibiscus, and the shrubby althea, which must not be confounded with the true *Althea,* one species of which (*A. officinalis*) furnishes the marsh-mallow of commerce. *H. cannabinus* affords a jute-

like fiber sometimes called bastard hemp. In the marshes along the Atlantic coast of the United States grows the beautiful rose mallow (*H. moscheutos*), very completely illustrated in Fig. 149. The nearly related genus *Abelmoschus* contains plants with aromatic properties, some of which are used in the manufacture of perfume. *A. esculentus* is the okra, one of the leading vegetables in the South, where it is extensively used both as a table vegetable and as the basis for soups.

In our western States, particularly on the Pacific coast, there are numerous wild mallows belonging to the genera *Sphaeralcea* and *Malvastrum*. *Malvaviscus*, *Pavonia* and *Abutilon* yield handsome greenhouse plants. *Malva*, with several species, is found as a weed in many parts of the world.

Family Bombacaceae. Silk-cotton Family. Contains 20 genera and about 100 species, widely distributed in the tropics of both hemispheres. Tney are trees of characteristic appearance, usually with palmately lobed or compound leaves, large solitary flowers, and capsules containing numerous seeds invested with a copious supply of down. The baobab of Africa (*Adansonia digitata*) which has been frequently described, is a member of this family. The accompanying figure (150) gives a good idea of the habit of the tree, with its enormous trunk, and also of the foliage, flowers and fruit. *Ceiba* is the common silk-cotton tree of the West Indies. The family may be distinguished from the Malvaceae by the fact that the stamens are in five or more sets.

Family Sterculiaceae. Sterculia Family. Contsins about 40 genera and 500 species, mainly South African and Australian. They are trees, shrubs or herbs, closely related to the preceding families, from which they differ in having the anthers of the stamens 2-celled. The seven tribes exhibit remarkable diversity in structure, so that it is not possible to give a more complete account of family Characters. One of the most important economic genera is *Theobroma* (see Eig. 151). Chocolate in all its forms is the product of the ripe seeds of *T. Cacao*, which are first fermented and then dried. The tree is successfully cultivated in many parts of South America. A valuable tonic is furnished by the juice of the cola nut (*Cola acuminata*), which, although a native of Africa, has been extensively introduced into South America. Others of the Sterculiaceae are in ornamental cultivation.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS

By Charles Louis Pollard.

CHAPTER XXV.

Order Parietales.

The name of this order is taken from a Greek word meaning *wall*, on account of the fact that the ovule-bearing surfaces (placentae) are attached to the walls of the ovary instead of forming a separate column. This condition may be plainly seen by sectioning the capsule of a violet or pansy. The ovary in this group is compound, and the stamens almost always numerous. It contains thirty-one families, many of them small and not well known; the most important ones are the Theaceae, Hypericaceae, Guttiferae, Cistaceae, Violaceae, Dipterocarpaceae, Passifloraceae, Caricaceae and Begoniaceae.

Fig. 152. Flowering shoot of *Dillenia Indica*, greatly reduced. Redrawn from Engler.

Family Dilleniaceae. Dillenia Family. A group containing about 30 genera and 250 species, consisting of trees or shrubs widely distributed in Australia, Indis, and some parts of South America. They may be distinguished by the five persistent sepals, borne in two rows, the five deciduous petals, and the numerous stamens, frequently bent over to one side. The fruit consists of several carpels, and is sometimes edible. Some of the trees

produce valuable timber, and many of them, as *Dillenia speciosa*, have handsome flowers, rendering them desirable for greenhouse cultivation (see Fig. 152).

Family Eucryphiaceae. Eucryphia Family. Consists of a single genus, *Eucryphia*, which presents rather anomalous characters, and has been placed by some authors in the Rose Family, and by others with the St. Johnsworts. There are four species, two in Chile and two in southern Australia and Tasmania; and oddly enough, one species in each of these pairs has pinnate leaves, the other simple entire leaves. All are trees or tall shrubs, having showy solitary flowers with four or five sepals, four or five petals, and innumerable stamens; the ovary is 5-12-celled, becoming in fruit a woody capsule containing winged seeds. One of the Tasmanian species, *E. Billardieri*, is a most beautiful forest tree, attaining lofty proportions, and at certain seasons is covered with large white flowers.

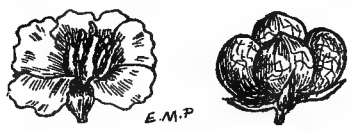


Fig. 153, Flower of *Ouratea spectabilis* and fruit of *O. elegans*. Redrawn from Engler.

Family Ochnaceae. Ochna Family. Includes 17 genera and over 200 species, trees or shrubs of exclusively tropical distribution. Their bark contains a yellow coloring matter, and is also very astringent, in consequence of which several species furnish tonics. The flowers are generally large and conspicuous, having the parts in fives, and the stamens often turned to one side; the carpels of the ovary are situated upon an enlarged base or *receptacle*, which becomes fleshy in fruit, like that of the strawberry. The largest genus is *Ouratea*, chiefly of West Indian distribution, some species of which are used as greenhouse plants (see Fig 153).

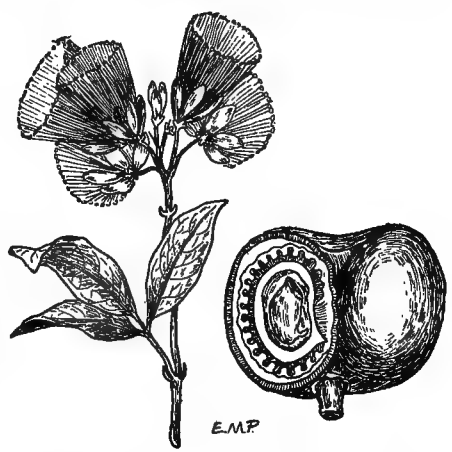


Fig. 154. Flowering branch of *Caryocar glabrum*, and fruit, partly sectioned, of *C. nuciferum*, both greatly reduced. Redrawn from Engler.

Family Caryocaraceae. Souari-nut family. Consists of two genera, *Caryocar* and *Anthodiscus*, the former with 10, the latter with 3 species, all South American trees. The Souari-nut, *Caryocar nuciferum*, may be taken as typical of the genus; it is a lofty forest tree with very durable timber, largely employed in ship-building. The leaves are compound, having three leaflets; the flowers are of large size, with five

sepals, five petals, and numerous long slender stamens borne in a ring. The fruit is also large, containing from two to four kidney-shaped nuts or seeds with a flavor somewhat resembling that of the Brazil nut; a superior quality of oil is extracted from them. Fig. 154 shows a flowering branch of *C. glabrum* and the fruit of *C. nuciferum*.

Family Marcgraviaceae. Marcgravia Family. Contains 5 genera and about 40 species, natives of tropical America. They are trees or shrubs, distinguished by the peculiar pitcher-like bracts which often subtend the flowers. In *Marcgravia* the flowers have the further peculiarity that the corolla is united in one piece (gamopetalous) which falls off like a cap. The stamens are usually numerous, the ovary 1-celled, becoming capsular in fruit.

Family Quiinaceae. Quiina Family. A small and unimportant South American family of trees, consisting of two genera and 19 species.

Family Theaceae. Tea or Camellia Family. Contains about 16 genera and 160 species, rather widely distributed. They are trees or shrubs with large regular flowers having usually 5 imbricated sepals, 5 petals, numerous hypogynous stamens and a 2-celled ovary, becoming in fruit a woody capsule.

The representatives of this family in our territory are shrubs of great beauty when in bloom, their large, solitary white flowers suggesting single roses. There are two genera, *Stuartia* and *Gordonia*, both natives of the Southern States, the latter known as the loblolly bay. But it is the genus *Thea* (including *Camellia*) which lends great commercial importance to the family. The genus consists of about 16 species of shrubs, confined in the wild state to India, China and Japan, but cultivated in many parts of the world. The flowers are large and handsome, and are succeeded by 3-valved capsules, two of which are shown in the illustration (Fig. 155).

Fig. 155. Flowers and fruit of the tea plant (*Thea Sinensis*), about one-third natural size. Redrawn from Engler.

The process of drying the tea leaves is an elaborate one, and upon the methods employed depends the flavor of the final product. The

highly expensive fancy teas are made of the young leaves and flower buds, but only a small quantity of these grades is ever imported. The active principle in the leaves is an alkaloid known as theine, and the percentage of tannin is very high. The family Theaceae has also been known by the name Ternstroemiaceae.

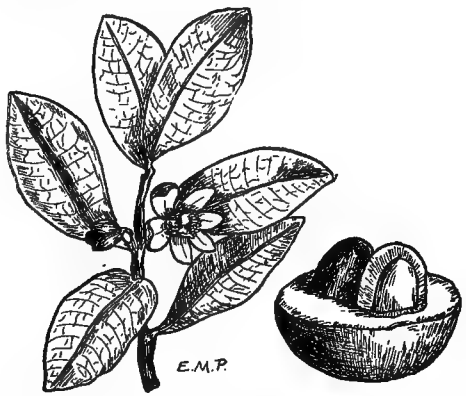


Fig. 156. The flowers and fruit of the mammey apple (*Mammea Americana*) greatly reduced. Original.

Family Guttiferae. Gamboge Family. A tropical group comprising about 30 genera and 300 species, trees or shrubs abounding in resin, with opposite leaves and flowers often incomplete or irregular; sepals and petals 2-8; stamens numerous, frequently united; fruit dry or pulpy. The family is of considerable economic importance. The yellow coloring matter known as gamboge is obtained from a species of *Garcinia*, the largest genus in the family. *G. Mangostana* is the mangostan or mangosteen, the fruit of which is described by all who have eaten it as being without a peer in the vegetable kingdom. A writer on Javanese fruits says: "It is of the size of a small orange, when ripe reddish-brown, and when old of a chestnut-brown color. Its succulent rind is nearly the fourth of an inch in thickness * * On removing the rind, its esculent substance appears in the form of a juicy pulp having the whiteness and solubility of snow, and of a refreshing, delicate, delicious flavour. We were all anxious to carry away with us some precise expression of its qualities; but after satisfying ourselves that it partook of the compound taste of the pineapple and the peach, we were obliged to confess that it had many

Fig. 157. The large golden St. Johnswort (*Hypericum aureum*); flowering branch and detached capsule, about one-half natural size. Original.

other equally good but utterly inexpressible qualities." The seeds of *G. Indica* yield cocum oil, used in India as an adulterant for butter, and also as a drug.

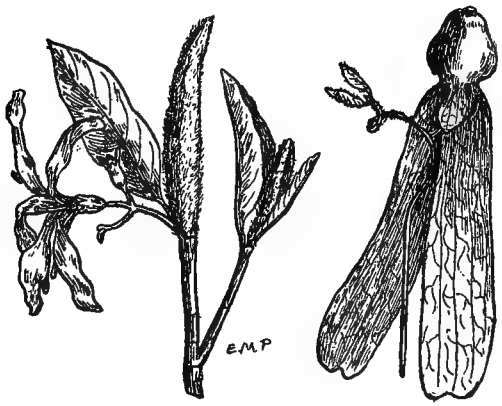


Fig. 158. Flowering branch and detached fruit of *Dipterocarpus retusus*, greatly reduced. Redrawn from Engler.

Another plant of this family producing an edible fruit is the mammey apple (*Mammea Americana*), the "mamey sapota" of the West Indies. It has a somewhat insipid flavor, but is popalar among the natives (see Fig. 156.) *Pentadesma butyraceum* is the butter tree of Sierra Leone. *Calophyllum* is another rather large genus noted for the oil yielded by its seeds, called Keena oil; the timber produced by these trees is also of good quality.

Family Hypericaceae. St. John's-wort Family. Contains about 10 genera and 280 species, mostly herbs and shrubs of wide distribution, a few trees in tropical regions. They have opposite or whorled leaves, and solitary or panicled flowers with 4-5 sepals, 4-5 petals, innumerable stamens and an ovary of 1-7 carpels, becoming a capsule in fruit.

Fig. 159. *Reaumeria Persica*, an entire plant, greatly reduced. Redrawn from Engler.

The St. John's-worts embrace several of our annoying weeds, as well as some of our most picturesque wild plants. The species of *Hypericum* shown in the illustration (see Fig. 157) is a native of the Southern States in hilly situations, and has very large golden-yellow flowers, rendering it desirable for cultivation. Among our familiar plants belonging to this family may be mentioned the spotted St. John's-wort (*H. maculatum*) the orange grass or pinweed (*Sarothra gentianoides*); and the St. Peter's-wort (*Ascyrum hypericoides*). The black or pellucid dots in the leaves of hypericaceous plants contain an essential oil.

Family Dipterocarpaceae. Wing-fruit family. Contains 16 genera and over 300 species, natives exclusively of the Asiatic tropics. They are trees of lofty proportions, resembling the Guttiferae in the abundance of resinous juice which they contain. The flowers are distinguished by the calyx, which is divided into five unequal sepals, two of them very large and wing-like. The whole calyx forms a persistent crown on the fruit, which is of woody texture, 1-celled and 1-seeded. The resin of various species is used as a medicine and also as an illuminant. Fig. 158 gives a good idea of the peculiar fruit.

Family Elatinaceae. Water-wort family. This group of marsh or aquatic herbs consists of two genera, *Elatine* and *Bergia*, wirh about 25 species of wide distribution. They have opposite or whorled leaves, with small regular flowers having 2-5 sepals, 2-5 petals, as many or twice as many stamens, and a 2-5-celled ovary becoming capsular in fruit.

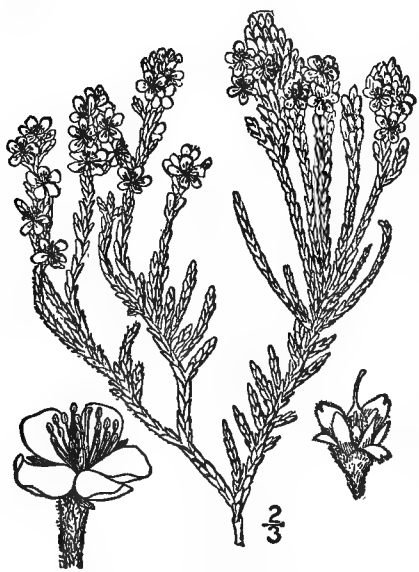


Fig. 160. Woolly Hudsonia (*Hudsonia tomentosa*). After Britton and Brown, Ill. Fl. Northeast, U. S.

Family Frankeniaceae. Frankenia Family. Four genera and about 15 species of maritime undershrubs of heath-like aspect, widely distributed in tropical or subtropical regions. *Frankenia* is represented by a species on the coast of southern California. The capsule differs from that in related families by being one-celled.

Family Tamaricaceae. Tamarisk Family. Contains 4 genera and about 40 species, trees or shrubs of wide distribution, with small alternate leaves and white or pink solitary or clustered flowers. The ovary is of rather unusual structure, being imperfectly 3-celled by the intrusion of 3 placentas or partitions. The seeds bear tufts of hairs.

Tamarix, the tamarisk of Europe, represented by several species, is a graceful small tree with handsome racemes of pink flowers. *Myricaria*, a closely related genus, occurs in northern Europe and Asia. *Reaumuria*, a genus of low undershrubs, is found in the Mediterranean region and in central Asia (see Fig. 159).

Family Fouquieriaceae. Candle-tree Family. Contains the single genus *Fouquiera* with about 5 species, natives of Mexico and the Southwest. *F. splendens*, the "ocotilla" of the Mexicans, is a beautiful tree

in the desert situations where it occurs, being covered at certain seasons with brilliant scarlet flowers.

Family Cistaceae. Rock-rose Family. Contains four genera and about 160 species, natives almost exclusively of the northern hemisphere, and abundant in both North America and Europe. They are shrubs or somewhat woody herbs, with simple leaves and solitary or clustered flowers, the latter regular. Sepals 3-5; petals 3-5 or wanting; stamens numerous; ovary 1-several-celled, capsular in fruit. Three genera are represented in North America. The pinweeds (*Lechea*) are small plants with insignificant flowers and a wonderfully large number of species. The frostweeds (*Helianthemum*) have for the most part rather showy yellow or white, but very evanescent flowers. *Hudsonia* contains 3 species of little heath-like plants with hoary foliage and starry yellow flowers (see Fig. 160). In Europe the species of *Cistus* are very numerous, and many of them have flowers of considerable size and beauty. *C. Creticus* yields the gum ladanum, used as a perfume, having a pleasant balsamic fragrance. *C. ladaniferus* in Spain and Portugal yields a similar product.

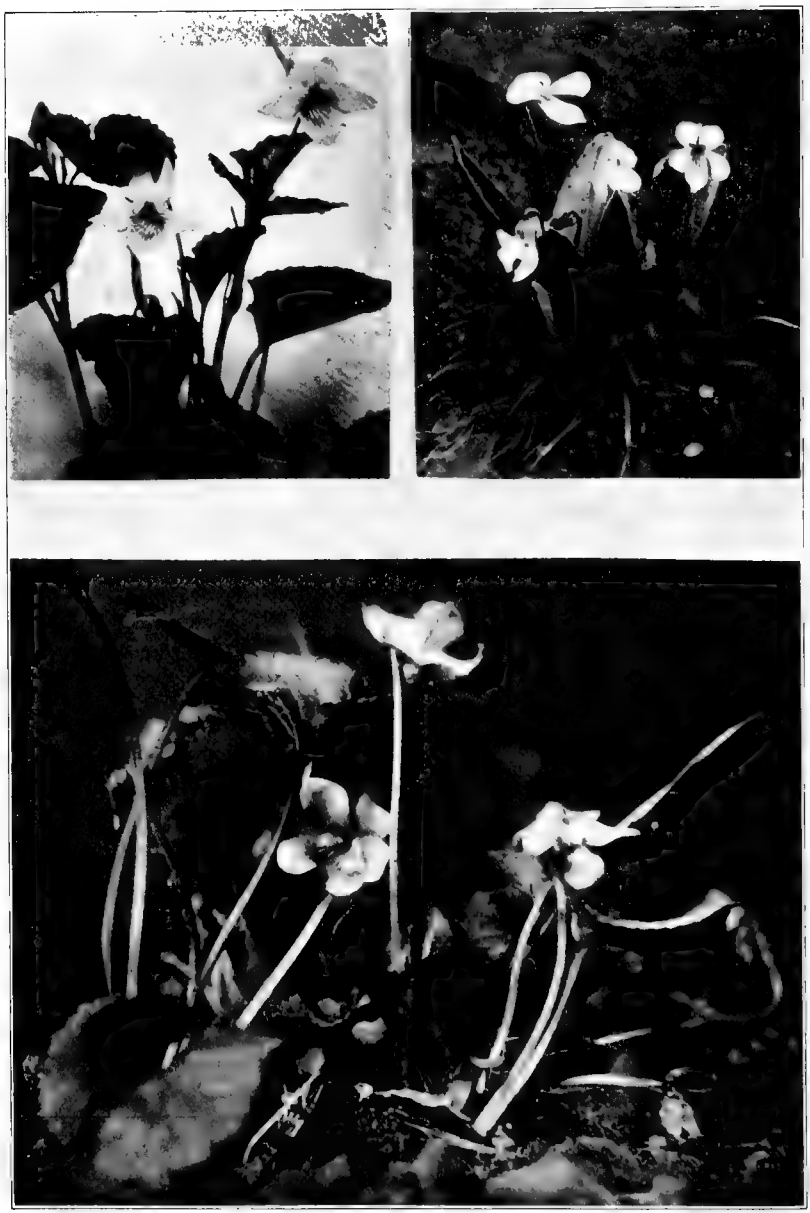


Fig. 162. American violets: upper left-hand, *V. rostrata;* upper right-hand, *V. primulaefolia;* lowermost, *V. papilionacea.* After photographs by Dr. Adolph Koenig.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS

By Charles Louis Pollard.

CHAPTER XXV.—*Continued.*

Family Bixaceae. Bixa Family. Contains 4 genera and about 20 species, mostly tropical, but *Amoreuxia*, a mallow-like herb with large flowers, reaches our southwestern borders. The type of the family, *Bixa*, consists of the single species, *B. Orellana*. It is a small tree with broad, cordate leaves, somewhat suggesting those of a poplar, and clusters of pink flowers having very numerous stamens and a 2-lobed stigma (see Fig. 161). The fruit is a very spiny pod which splits into several valves when ripe; the seeds have a red, waxy coating, constituting the substance known as arnotto. This is an orange coloring matter used as a dye, and also to impart a color to butter. Since the discovery of a method by which it can be prepared synthetically by chemical processes, the value of arnotto has depreciated.

Family Cochlospermaceae. Shell-seed Family. Contains two or three genera and abous 18 species, most of which are included in *Cochlospermum*. They are shrubs or small trees with palmately-lobed, long-stalked leaves, and large yellow flowers in terminal panicles. The chief difference between this family and the preceding lies in the single, unbranched stigma and the downy seeds. Some species of *Cochlospermum*, which is exclusively tropical, yield a variety of gum, while others furnish a yellow dye somewhat similar, but inferior to arnotto.

Family Koeberliniaceae. Junco Family. Consists of the single genus and species *Koeberlinia spinosa*, a remarkable shrub of the Rio Grande region in Texas and Mexico. It is apparently quite destitute of leaves, the latter being minute and promptly deciduous. The smooth green branches and twigs taper to sharp spiny points; the small white flowers, which are borne in umbel-like clusters, have 4 sepals, 4 petals, 8 stamens, and a 1-celled ovary becoming a black berry in fruit.

Family Violaceae. Violet Family. Includes about 15 genera and 325 species, of wide distribution. Many of the tropical genera are shrubs or trees, but in temperate climates the plants are mostly peren-

nial herbs. The genus *Viola* far outnumbers other members of the family, having nearly 200 species, about equally divided between the Old and the New World. Without possessing any claims to showiness, the violet is one of the most attractive as well as artistic flowers to be found throughout the whole range of seed plants. Before discussing the distinct types of habit and floral structure, let us examine the characters of the Violet Family. They have leaves provided with stipules (leafy bracts) at the base, and solitary or clustered irregular flowers. The sepals are 5; the corolla also consists of 5 petals, the lower one of which is usually much larger and differently shaped, or else provided

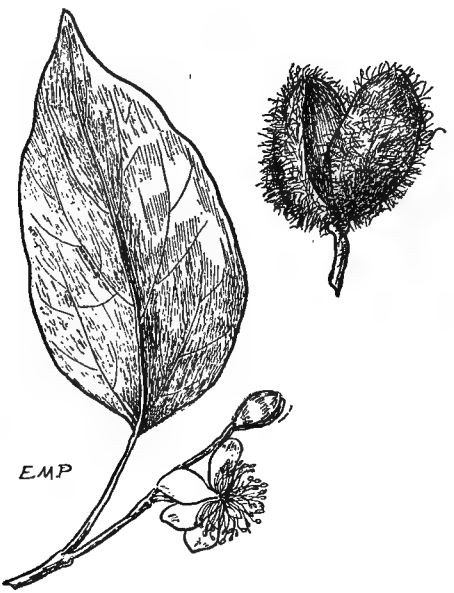


Fig. 161. Flower and fruit of *Bixa Orellana*, considerably reduced. Original.

with a spur. A twist in the peduncle causes this petal frequently to appear uppermost. There are 5 stamens, the anthers being more or less united into a ring. The ovary is 1-celled, with 3 placentae or partitions, developing into a 3-valved capsule.

We may dismiss most of the genera with brief consideration. *Cubelium*, the so-called green violet of our Atlantic States, does not afford a hint of its relationship in its coarse foliage and upright stems; but the tiny flowers scattered along the latter are decidedly suggestive of undersized and starved violet blooms. *Calceolaria* is a herb of the southwest and the tropics, the flowers of which are also inconspicuous.

Probably there is no other genus of flowering plants in which the divisions are so well marked as in *Viola*, and the species fall into natu-

ral groups which have been by some authors advanced to generic rank. For example, we have in America the beautiful bird's-foot violets, which are distinguished by their finely divided foliage, very short and truncate rootstocks, and the large beakless stigma. This includes the handsome prairie violet of the West, and the striking pansy violet so common in Maryland and Virginia but rare elsewhere. In general the genus may be roughly separated into two divisions: those with leafy stems, and those which are scapose, *i. e.*, in which the leaves and flowers seem to spring directly from the root. In Fig. 162 we have representatives of several of these types displayed.

The pansy (*V. tricolor*) has been for so long a time in cultivation that the range of color and markings is wonderful. These markings are apt

Fig. 163. Flowering branch of *Casearia sylvestris*, with detached enlarged flower of *C, tomentosa*. Redrawn from Engler.

to assume certain definite patterns, so that horticulturalists speak of the various "strains" of the pansy. The foliage is quite distinctive on account of the large stipules. In this country we have only one member of the group, the little annual white violet (*V. Rafinesquii*), but in Europe a large number of species closely related to *V. tricolor* have been described.

The perfume of the violet has always been highly esteemed, and is most prominent in the cultivated forms of *V. odorata*, although some of our native species are faintly sweet-scented.

Family Flacourtiaceae. Flacourtia Family. Contains 70 genera and about 300 species, tropical shrubs or trees of wide distribution. They have alternate leaves, and flowers with 4-7 sepals and petals, or the latter sometimes wanting. The stamens are equal to or some multiple of the petals. The fruit is either a fleshy berry or a 4-5-valved capsule; it is edible in some species. *Flacourtia* yields a powerful

Fig. 164. *Piriqueta Caroliniana*, one-half natural size. Original.

astringent. *Casearia* is one of the largest genera in the family, being particularly abundant in the West Indies and South America. Many of its species possess medicinal properties.

Family Stachyuraceae. Stachyurus Family. Consists of the single genus *Stachyurus*, with two east Asiatic species.

Family Turneraceae. Turnera Family. Contains 6 genera and about 90 species, most of which are comprised in *Turnera* and *Piriqueta*. They are herbs or undershrubs with alternate leaves and yellow, or rarely blue flowers; the corolla, which consists of 5 petals, is rather fugacious, and disappears early; the calyx is somewhat bell-shaped; stamens 5; style forking; fruit capsular.

Piriqueta Caroliniana is a common plant of the Florida pine barrens, and resembles a rock-rose (*Helianthemum*) when its yellow flowers are expanded in the sunlight (see Fig. 164). The drug known as damiana is derived from a Mexican species of *Turnera* (*T. aphrodisiaca*) and also from the West Indian *T. diffusa*.

Family Malesherbiaceae. Crownwort Family. Consists of the single genus *Malesherbia*, with about 15 species, natives of Peru and adjacent countries on the west coast of South America. They are herbs or low shrubs with alternate leaves and solitary yellow or blue flowers. The calyx is tubular, and merely 5-lobed, being gamosepalous

Fig. 165. Flower and leaf of *Passiflora foetida*, showing the corona, and the finely dissected bracts surrounding the flower. Original.

(not divided into distinct sepals). The petals are 5, persistent; stamens 5-10, their filaments often connected with the 3 styles, forming a column; ovary borne on a stalk, 1-celled; fruit a 3-valved capsule. These plants are closely allied to the true passion-flowers, and were formerly included in the same family.

Family Passifloraceae. Passion-flower Family. Contains 15 genera and about 300 species, of wide distribution, mostly in tropical regions. Of these, *Passiflora*, with about 250 species, is by far the most important. The plants are herbs or shrubs, often climbing, with alternate leaves and mostly solitary flowers. The calyx is 5-lobed; the petals 5, frequently clothed on their upper surfaces with small processes or filaments; stamens 5, monadelphous;

ovary 1-celled, stalked, with 3 styles; fruit 1-celled, either a dry or pulpy capsule. The flower of *Passiflora* is peculiar in having the filamentous processes disposed in a ring within the petals, so that they appear like stamens. This is shown in Fig. 165, and is called the crown or corona.

Most of the species of Passion-flower are natives of South America; a few reach our southern borders, and two (*P. lutea* and *P. incarnata*) extend as far north as Washington. The latter species is an extremely abundant weed in the South, where it is known as "may-pops," from the yellow, edible fruit. Many species are in cultivation in our gardens.

Fig. 166. Flower and leaf of *Mentzelia decapetala*, considerably reduced. Original.

The name Passion-flower has been given to the plant on account of the symbolic numbers which its various parts exhibit; "thus the three nails—two for the hands, one for the feet—are represented by the stigmas; the five anthers indicate the five wounds; the rays of glory, or, some say, the crown of thorns, are represented by the rays of the 'corona;' the ten parts of the perianth represent the Apostles, two of them absent—Peter who denied, and Judas who betrayed our Lord; and the wicked hands of His persecutors are seen in the digitate leaves of the plant, and the scourges in the tendrils."—(*Treasury of Botany.*)

Family Achariaceae. Acharia Family. Contains 3 genera, each with a single species, the plants formerly included in the preceding group.

Family Caricaceae. Papaya Family. Two genera, *Carica*, with

about 20, and *Jacaratia* with 6 species, all tropical trees. They are dioecious, the male flowers being disposed in loose clusters, with a funnel-form gamopetalous corolla, on the throat of which are borne the 10 stamens. The female flowers are smaller, with a corolla of 5 distinct petals. The fruit is oblong, very large, with a pulpy interior and a thick fleshy rind. In the tropics it is universally known as the papaw, a name, however, which is more properly applied to our northern tree, *Asimina triloba*. The most widely diffused species is *Carica Papaya*; it is sometimes known as the melon-tree. The fruit is not unlike a melon in shape, but is of a dull orange-yellow color; in flavor, to the uninitiated at least, it resembles a hybrid between a melon and a pumpkin; it is, however, seldom eaten raw, but is usually made into a preserve or sauce; the green fruit is either pickled, or boiled and eaten as a vegetable.

Family Loasaceae. Loasa Family. These are herbs, usually rough with glutinous or sometimes stinging hairs, and having white, yellow, or reddish flowers. The calyx-tube is united with the surface of the ovary, so that the latter is said to be *inferior*. Petals 4 or 5; stamens exceedingly numerous; ovary 1-celled, capsular in fruit. There are 13 genera and 200 species, all but one of which are American. *Mentzelia* is a conspicuous genus on the western plains, the yellow or white flowers of some of the species expanding five or six inches (see Fig. 166). Several other genera furnish greenhouse plants.

Family Datiscaceae. Datisca Family. Contains 3 genera. Two of these are monotypic; the other, *Datisca*, is represented by one species on the Pacific coast (*D. glomerata*) and one throughout southwestern Asia (*D. cannabina*). The plants are herbs or trees with monoecious or dioecious flowers entirely destitute of corollas. Stamens 3-7; ovary 1-celled, capsular in fruit. They possess bitter and purgative qualities. The resemblance between *Datisca* and the hemp (*Cannabis*) is so striking that the former is frequently called "false hemp."

Family Begoniaceae. Begonia Family. Contains 4 genera, two with one species, one with 3 species, and *Begonia* itself with about 200. The plants are succulent herbs or undershrubs, widely distributed in tropical regions. The leaves are alternate, provided with stipules, and almost invariably oblique in form; the flowers are monoecious, with only a calyx, which is colored like a corolla, and is superior to the ovary. The numerous stamens are aggregated in a head. Stigmas 3; fruit 3-valved and winged. The plants furnish many species valued in cultivation either for their foliage or flowers; they also possess medicinal properties.

Family Ancistrocladaceae. Ancistrocladus Family. A peculiar group, consisting of a single genus, *Ancistrocladus*, with 8 species, inhabiting the East Indies. They are climbing shrubs with hook-like branches, panicled flowers with ten stamens of two different lengths, and a 1-celled ovary.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

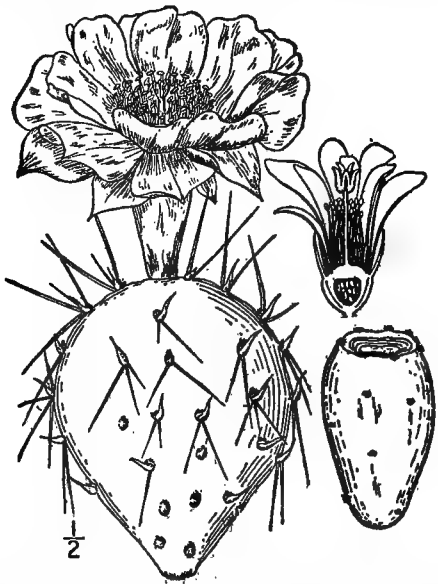
CHAPTER XXVI.—*Orders Opuntiales and Myrtiflorae.*

THE first-named order, which takes its name from the genus of cacti to which the prickly pear belongs, consists only of the following:

Family Cactaceae. Cactus Family. This very widely known group, perhaps the most distinctive of any of the plant families, comprises about 20 genera and 900 species, all of which are natives of the western hemisphere; many of them have, however, been naturalized in the Old World. Their chief characteristic is the extremely succulent tissue of which the plants are composed, making it possible for them to thrive in very arid regions. In fact, cacti are never to be found either in moist situations or in a humid climate.

In habit the plants also exhibit wide variation. A few have leafy stems, similar to those of most plants; but the great majority have swollen, spherical, jointed or angular stems, with practically no leaves whatever, the latter being represented by minute spines and their place being taken by clusters of sharp spines. The flowers are usually regular, with a calyx of numerous combined sepals, and a corolla of numerous petals. The stamens, which have very long filaments, are also innumerable. The ovary is one-celled with a single style and several stigmas. The fruit is fleshy and frequently edible, with a pleasant subacid flavor.

On account of the ease with which they may be cultivated, the oddity of their shapes and the beauty of their flowers, the Cactaceae have always been popular as house plants. The genus *Cereus* stands pre-eminent in the number of species and variety of flowers. Everyone is familiar with *Cereus grandiflorus*, the "night-blooming" Cereus, and those who have traveled through the desert regions of Arizona and New Mexico have observed the tall columnar stems of the giant cactus (*C. giganteus*) indigenous throughout that region. Scarcely less interesting are the various forms of prickly-pears (species of *Opuntia*), which serve a number of useful purposes in the countries where they grow. The tuna (*O. Tuna*) is used as a hedge, and the young juicy joints of this, after the spines have been singed off, are eaten by cattle. *O. Ficus-*



Western prickly pear (*Opuntia humifusa*). After Britt. & Brown Ill. Fl. Northeast U. S.

Indica, which now occurs throughout Southern Europe, is the food plant of the cochineal insect. Our own native Opuntias are highly ornamental in the dry fields and rocky ledges when covered in early summer with a mass of yellow flowers. The genus *Echinocactus* is noted for its very formidable hooked spines; while *Cactus* (*Mamillaria*), a genus in which the plants are of small size and the flowers of bright colors, is particularly desirable in pot cultivation.

The order MYRTIFLORAE, or MYRTALES, may be known by the gamosepalous calyx, the sepals being joined together, and by the compound ovary, to which the calyx is usually adnate. There are 16 families, of which the most important are the Thymelaeaceae, Lythraceae, Rhizophoraceae, Combretaceae, Myrtaceae, Melastomaceae and Onagraceae.

Family Geissolomaceae. Geissoloma Family. Consists of a single genus, *Geissoloma*, confined to the Cape of Good Hope. They are low shrubs of no particular interest.

Family Penaeaceae. Consists of about 5 genera and 20 species, also natives of South Africa. The parts of the flower are in fours, and the ovary affords an exception to the usual rule in the order, in that it is superior to, or free from, the calyx.

Family Oliniaceae. Olinia Family. Another family with a single genus, native of the same region.

Family Thymelaeaceae. Mezereon Family. Shrubs or trees with peculiarly tough inner bark. They have entire leaves, and flowers with

a cylindric calyx, the corolla being frequently wanting; the stamens are 4–5 or twice as many, borne on the calyx. There are about 37 genera and 425 species, the family being largely represented in Australia and South Africa, but some of the genera exhibiting a wide distribution. One of the largest is *Daphne*, species of which are found in the temperate portions of nearly every continent. *D. Mezereum* is well-known in Europe and cultivated for its fragrant pink flowers, appearing in spring

Fig. 168. European Mezereon (*Daphne Mezereum*).

before the leaves expand. The bark of this and the Spurge Laurel (*D. Laureola*) has been used in medicine; it is exceedingly acrid. A very good quality of paper is manufactured from the tough inner bark of certain Asiatic species.

In the United States the family is represented by the leather-wood or moosewood (*Dirca palustris*) a shrub with small yellow flowers and withe-like stems. In Australia, *Pimelea* comprises many species, some of which are ornamental in cultivation.

Family Elaeagnaceae. Oleaster Family. Contains 3 genera and about 20 species of wide distribution. They are shrubs or trees, peculiar and conspicuous on account of their silvery-scaly foliage. The flowers are variously clustered and dioecious, the staminate flowers with a 4-parted calyx and 4 or 8 stamens, the pistillate with the upper

portion 4-lobed and deciduous, the lower half enclosing the ovary and persistent; corolla wanting in both kinds of flowers. The fruit is a berry-like drupe.

Elaeagnus, the oleaster or wild olive, is represented in North America only by *E. argentea*, the silver berry of the Western States. In Europe a number of species are in cultivation, and one, *E. longipes*,

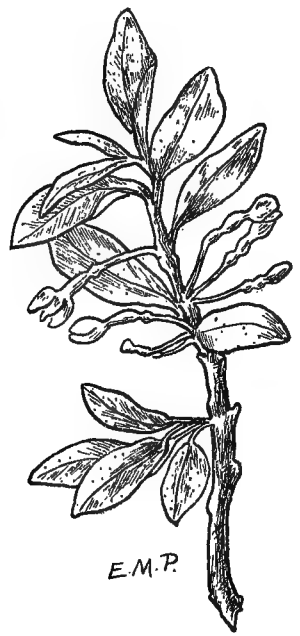


Fig. 169. Japanese Goumi (*Elaeagnus longipes*).

produces a fruit which is edible, and which has grown more popular as it has become more widely introduced. *Lysargyraea*, the buffalo berry, consists of three species, all North American shrubs. *Hippophae*, of similar aspect, belong to the Old World.

Family Lythraceae. Loosestrife Family. Contains about 21 genera and 350 species of very wide distribution. They are herbs, shrubs or even trees, mostly with opposite leaves. The flowers have petals as many as the lobes of the calyx, on which they are borne, or the corolla sometimes entirely wanting. Stamens as many as the calyx-lobes. Fruit a capsule, with 1–several cells.

The Loosestrifes proper (*Lythrum*) are herbs with somewhat weedy aspect, of which *L. Salicaria* is common to both Europe and America. The very large genus *Cuphea*, containing numerous Mexican species, exhibiting great diversity in the form and coloration of their flowers, which are irregular in shape, is represented in the United States only

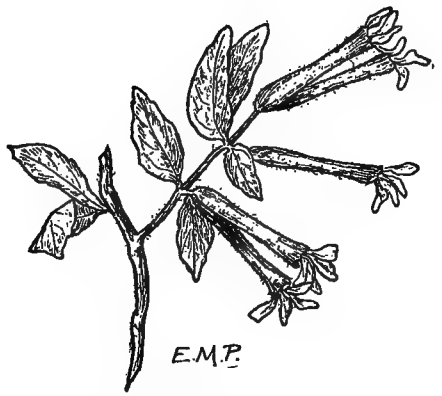


Fig. 170. Firey Cuphea (*Cuphea Llavæ*).

by the clammy cuphea, a troublesome weed with insignificant flowers. *Lagerstroemia*, the crape myrtle, is probably the most highly ornamental shrub of the Southern States. Originally introduced from Southern Asia, it has been so commonly cultivated that it has become spontaneous in many places. The leaves are dark glossy green, and the delicate pink flowers, produced in lilac-like masses, have a texture similar to crape, the petals being borne on long claws and beautifully fringed.

Family Sonneratiaceae. Sonneratia Family. Consists of a single genus *Sonneratia*, with about eight species, natives of India and the Malay archipelago. They are trees with opposite leaves, large terminal flowers distinguished from those of the preceding family by the numerous stamens, and a berry-like fruit. The kambala, *S. apetala*, furnishes a strong, close-grained wood, used in the manufacture of packing-cases.

Family Punicaceae. Pomegranate Family. This group, of which the pomegranate is the type, was formerly included in the Lythraceae, but is separated from that family on account of the peculiar structure of the fruit, which consists of two rows of capsules, placed one above another. The numerous seeds are enveloped in a transparent, mucilaginous coating. The flowers are highly ornamental, being usually a vivid scarlet, while the fruit is yellow, tinged with orange. The flavor is pleasant, and moderately acid. Pomegranates are natives of Asia and Africa, but they may be cultivated wherever the climate is sufficiently mild.

Family Lecythidaceae. Brazil-nut Family. A group of large tropical trees comprised in 7 genera and about 130 species. They are natives of South America, having large showy flowers, the stamens in which are frequently united into a plate, woody capsules, and almond-

like seeds. The Brazil-nut is a familiar example; its fruit, partly sectioned, is shown in Figure 171.

Fig. 171. Fruit and seeds of the Brazil Nut (*Bertholletia excelsa*) greatly reduced.

Family Rhizophoraceae. Mangrove Family. This interesting group consists of about 14 genera and 50 species, shrubs or trees, some of which are not strictly maritime like the true mangroves. The great interest attaching to the latter lies in the fact that the seeds germinate while the fruit remains attached to the parent plant and the radicle projects downward like a plummet, ready to secure prompt attachment in the loose mud upon which it finally falls. The flowers have both calyx and corolla, each of 4 parts, the stamens as many or twice as many. The capsular fruit contains one or few seeds.* The mangroves proper belongs to the genus *Rhizophora*, but several related genera have the same habit. The family is distributed through the tropics of both hemispheres.

Family Combretaceae. Myrobalan Family. Contains about 23

Fig. 172. White buttonwood (*Conocarpus erecta*).

* See article by the author in the present number of this journal, on "Plant Agencies in the Formation of the Florida Keys," for an account of the mangrove.

genera and 200 species. They are trees or shrubs with opposite leaves, and flowers frequently exhibiting an odd system of irregularity in that the stamens may be wanting, the petals, or the pistil. Calyx 4–5-lobed, the upper portion falling off. Petals borne on the calyx, alternating with its lobes. Stamens as many or twice as many. Ovary 1-celled. Fruit dry or fleshy, 1-celled and 1-seeded.

The plants are widely distributed in the tropics, and, as a whole, possess astringent properties. Some, such as the Indian almond tree (*Terminalia Catappa*), are cultivated for ornament; others yield good timber. Several of the genera resemble the true mangroves in developing aerial roots; a few are lianas.

Fig. 178. The Flowering Dogwood (*Cornus florida*).
After Photograph by Carl Krebs.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

Chapter XXVI.—*Continued.*

FAMILY Myrtaceae. Myrtle Family. A vast and important family of nearly 100 genera and some 1700 species. They are trees or shrubs with entire, usually opposite and dotted leaves, these often having an intra-marginal vein. The flowers are borne in terminal or axillary racemes, panicles or rarely cymes, the individual flowers being perfect and regular, with the tubular calyx somewhat cohering at the apex and bearing the petals alternating with its lobes. The stamens are also inserted with the petals and are twice as many or oftener indefinite in number. The 1–6 celled ovary is adherent to the calyx and in fruit becomes dry or fleshy.

This family is widely distributed throughout the world, mainly in

Fig. 173. Flowering Branch of *Eucalyptus rostrata.*

the tropics, with a few forms extending into temperate lands. North America, for instance, has but 4 genera and about a dozen species, and these mostly confined to Florida. Australia possesses a number of peculiar and striking genera, among them *Eucalyptus*, a genus embracing about 160 species. They are usually tall trees, with narrow, leathery leaves. One species, the white peppermint-tree or giant gum-tree (*E. amygdalina*), is, according to the late Baron von Mueller, probably the loftiest tree on the globe, attaining a height of 475 feet and a diameter of 15 feet. This and many other species of *Eucalyptus* are of the greatest economic importance, furnishing timber for a wide variety of uses, as well as various oils, resins, acids, tannin, etc. *Eucalyptus* is thought to be of value in malarial regions in absorbing or warding off noxious emanations; hence, several are known as fever trees. Some 70 or 80 species of *Eucalyptus* have been more or less extensively introduced on the Pacific Coast, but only a few, such as *E. polyanthema*, *E. globulus* and *E. robusta*, are most abundant; all are of rapid growth.

Among the many economic products of this family we may mention allspice or pimento, the product of *Eugenia Pimenta* or *Pimenta officinalis*, a tree of Mexico and the West Indies. Allspice consists of the fruits gathered before they are quite ripe and dried in the sun. The cloves of commerce are the dried flower buds of *Eugenia caryophylla*, a tree originally of the Moluccas, but now widely cultivated in the East and West Indies. The guava tree (*Psidium Guajava*) of tropical America produces the well-known guava fruits of tropical countries. The myrtle of the ancients is *Myrtus communis*, a tree of the Mediterranean region.

Family Melastomaceae. Melastoma Family. This is also an

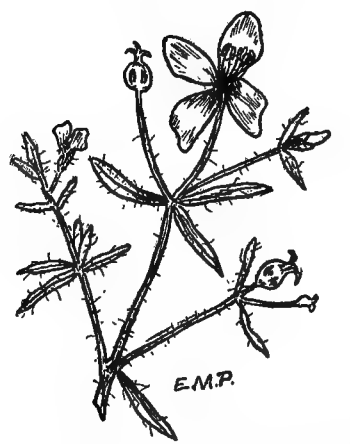


Fig 174. The Yellow Deer-grass (*Rhexia lutea.*)

immense family, which embraces about 150 genera and 2500 species. They are herbs, shrubs or trees, with mainly opposite 3–9-ribbed leaves with-

out stipules, and showy flowers, which are regular and perfect. The calyx is urn-shaped, 4–6-lobed, persistent and joined with the ovary below or with its angles. The petals, also 4–6 in number, are inserted with the 4–12 stamens on the throat of the calyx. The ovary is 2–many-celled and becomes in fruit a berry or a capsule.

This family is mainly tropical in its distribution, being especially abundant in Central and South America. Only a single genus (*Rhexia*) and less than a dozen species are North American. They are perennial herbs, usually 1–2 feet in height, with 3–5-ribbed leaves and handsome terminal purple, whitish or rarely yellow flowers. They delight in meadows and swamps and are known popularly as meadow-beauties or deer-grass.

In spite of the great number of genera and species the melastoma family is of no particular economic importance. It affords a number of showy greenhouse plants, among them certain tropical species of of *Rhexia*, species of *Miconia*, a large tropical American genus of shrubs or trees, cultivated for their large, showy, strongly veined leaves, and *Bertolonia*, a genus of dwarf shrubs from Brazil, also grown for their beautiful foliage.

Family Onagraceae. Evening-primrose Family. They are annual or perennial herbs, rarely shrubs, with alternate or opposite exstipulate leaves, and axillary spikes or racemes of perfect, mostly regular flowers. The calyx-tube is joined to the ovary or prolonged beyond it and usually 4-lobed. The petals are 2–9, but usually 4 in number, and inserted with the stamens (the same or twice as many) on the summit of the calyx-tube. The ovary, usually 4-celled, becomes a capsule or nut in fruit. This family includes about 40 genera and 350 species, of wide geographic distribution, but most abundant in America, there being about 30 genera and nearly 250 species in North America north of Mexico. Many of these are weeds of no particular account. Among the most interesting is *Epilobium*, the willow herbs, which spring up so quickly in ground recently burned over. They bear purple 4-parted flowers. *Oenothera*, the evening primrose, is a small genus of low herbs with showy, 4-parted yellow flowers. Allied to this are several genera bearing very large, showy, white, pink or yellow flowers. Among the plants of this family in cultivation *Fuchsia* is pre-eminent. It is a genus of 60 or 70 species, the greater part from tropical America, but with 3 or 4 in New Zealand. They are known to us mainly as tender herbs or sub-shrubs, but in their native countries they are shrubs and one, *Fuchsia excorticata*, of New Zealand, is a tree 30–40 feet in height. The number of forms in cultivation is very great, but they have apparently been produced by hybridizing a relatively small number of species.

Family Haloragidaceae. Water-milfoil Family. A small family of

8 genera and about 94 species, of wide geographic distribution. They are herbs, mainly aquatic, with alternate or whorled leaves and small flowers. The mare's-tail or bottle-brush (*Hippuris vulgaris*), the mermaid-weed (*Proserpinacea*) and the several species of water-milfoil (*Myriophyllum*) are common in our ponds, lakes and streams. Among the few terrestrial forms *Gunnera* is noteworthy. They are magnificent lawn foliage plants, the leaves of *G. marveata* being from 5–10 feet across, and the crown of great leaves spreading 25 feet or more.

Family Cynomoriaceae. Cynomorium Family. A single genus and species (*Cynomorium coccineum*), of the Mediterranean region and Western Asia. It is a fleshy red herbaceous plant about a foot in height.

Chapter XXVII.—Order Umbellales.

This is a small but interesting and relatively important order, embracing three families. They are herbs, shrubs, or trees, and almost always have petaliferous flowers. Calyx-segments and petals mostly 5, stamens 4 or 5. The ovary is inferior, adnate to the calyx, compound, and has a single ovule in each cell.

Family Araliaceae. Ginseng Family. A family of herbs, shrubs or trees of about 50 genera and 450 species, widely distributed in temperate and tropical regions. North America possesses only 3 genera and about 10 species. They have alternate or whorled leaves, and mostly perfect flowers in umbels, heads or racemes. The calyx-tube adheres to the ovary and has the usually 5 petals inserted in its margin. Stamens as many as the petals and alternate with them. Fruit a berry or drupe resulting from the 1–several celled ovary.

Aralia is perhaps the most important genus. They are herbs, shrubs or trees with pinnately or ternately decompound leaves. *Aralia spinosa*, the Hercules' club, a tall shrub or small tree of Eastern North America, has the stem, branches and petioles strongly spiny; *A. racemosa*, the American spikenard, is an unarmed herbaceous plant 3–6 feet high, and *A. nudicaulis* is the wild or Virginia sarsaparilla which is quite widely employed in medicine. Several other species of *Aralia* are in ornamental cultivation, mainly as greenhouse plants. *Panax* is a genus of about 7 species, natives of Eastern North America. They are erect perennial herbs from globose or elongated aromatic roots. American ginseng (*P. quinquefolia*), of rich woods, is gathered in large quantities for exportation to China, where it is highly prized for its tonic, aromatic properties and commands high prices. The only other American species

Fig. 175. Ginseng (*Panax quinquefolia*). After Britt & Brown, Ill. Fl. Northern U. S.

is the dwarf ginseng or ground-nut (*P. trifolium*), a smooth herb only 3–8 inches in height. The widely known English ivy (*Hedera Helix*) is also a member of this family. It is a native of the Old World, but is now grown in many varieties in nearly all parts of the world. The celebrated rice paper of the Chinese is made from the pith of *Fatsia papyrifera*. It is about 10 feet in height and 4 inches in diameter, with a white elder-like pith an inch or more in diameter. A number of other genera, as *Acanthopanax*, *Polyscias*, etc., are in ornamental cultivation.

Family Umbelliferae. Carrot Family. A large, widely distributed family of 170 genera and about 1600 species. They are herbs, often strongly scented, with alternate, mostly compound leaves and small, often inconspicuous flowers borne usually in single or compound umbels. The calyx-tube is short, joined with the ovary and bears the 5 petals on its margin. The stamens are also 5, but borne on a disk which surrounds the pistil. The fruit is dry and composed of two flattened carpels. Although closely circumscribed as a family, the genera and, species are often limited and discriminated with great difficulty.

This is on the whole an important family and supplies a number of edible plants, as the carrot, celery, parsnip, caraway, parsley and coriander; and in old gardens, lovage and fennel are grown for their sweet-aromatic foliage. Poison hemlock (*Conium*) water parsnip (*Sium*) and water hemlock (*Cicuta*) are rank-growing, ill-scented poisonous plants, not infrequently causing the death of persons eating the roots or stems.

Family Cornaceae. Dogwood Family. A small but interesting group of about 16 genera and 85 species. They are shrubs or trees with simple leaves and regular flowers in cymes, heads, or rarely solitary, and

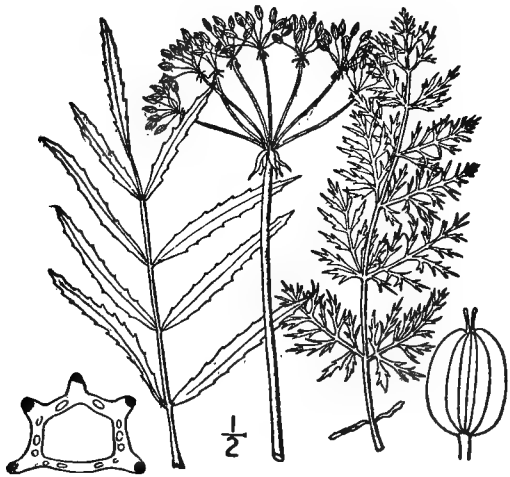


Fig. 176. Hemlock Water-parsnip (*Sium cicutaefolium*). After Britt & Brown, Ill. Fl. Northern U. S.

surrounded by an involucre. They are most abundant in the northern hemisphere, North America possessing 3 genera and about 35 species. Of these, the best known and most abundant is *Cornus*, including the dogwoods or cornels. About 18 species are found in this country, the

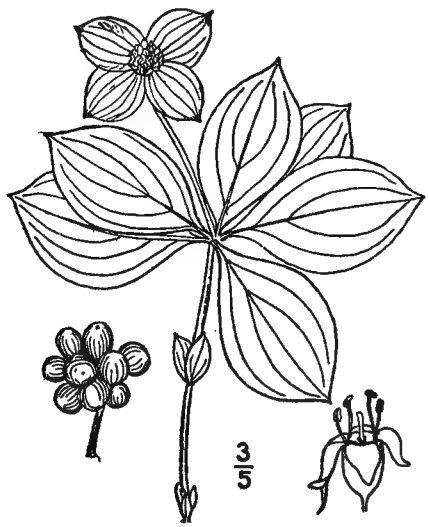


Fig. 177. Dwarf Cornel (*Cornus Canadensis*). After Britt & Brown, Ill. Fl. Northern U. S.

most conspicuous being the flowering dogwood (*C. florida*). A common species of low, cold northern woods is the little bunch berry (*C.*

Canadensis) and its close relative, *C. Suecica*. Another common species along streams and swamps is the red-osier dogwood (*C. stolonifera*). The genus *Nyssa* includes mainly trees, *N. sylvatica*, being the pepperidge, sour gum or tupelo, *N. biflora*, the water tupelo, and *N. aquatica*, the cotton or tupelo gum. *Aucuba Japonica*, a glossy, evergreen shrub from Japan, is common in cultivation. *Garrya* is the only other North American genus.

Fig. 178. The Mayflower (*Epigaea repens*).
After Photograph.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXVIII.—*Order Ericales.*

IN Chapter X (p. 70) of the Supplement, it will be remembered that the distinctions between the two main divisions of dicotyledonous plants, the Archichlamydeae and Metachlamydeae, were explained at length. We have now discussed all the orders and families comprised in the first named group, or those in which the corolla in the flower is either wanting entirely, or composed of separate pieces (petals). We now pass to the consideration of a higher type of floral structure, viz., that in which the corolla-segments are united into a single piece,—wherefore the group is sometimes called *Sympetalae* or *Gamopetalae*. It must not, however, be supposed that the union of petals is always complete. In the earlier families of the series, such as those discussed in the present chapter, the coherence is very slight or the petals are in some cases actually distinct. From this condition to the long tubular or funnel form corollas of the Convolvulaceae, for instance, there is every gradation.

The order Ericales is characterized by the superior ovary, free from the calyx (except among the blueberries, Vacciniaceae), and by the stamens which are free from the corolla, alternate with its lobes, and as many or twice as many as the latter. The families included are the Clethraceae, Pyrolaceae, Lennoaceae, Ericaceae, Epacridaceae and Diapensiaceae, all of which are very closely related, the first four having been formerly regarded as a single family, the Ericaceae.

Family Clethaaceae. White Alder Family. A single genus, *Clethra*, of about 30 species, inhabiting eastern North America, the Central and South American region, and Japan. They are shrubs and trees, with whitish or canescent foliage resembling in shape that of the alder. The flowers, which are borne in long, narrow racemes, are usually delightfully sweet-scented. The sepals and petals are 5, the latter only slightly united at the base. Stamens 10. Ovary 3-celled and 3-angled, becoming in fruit a 3-valved loculicidal capsule.

The sweet-pepper bush is one of the summer-flowering shrubs in our eastern States. Its spicy racemes of white flowers are borne in

great profusion, and are very attractive to insects. The genus contains about 25 species, distributed through East Asia and the Canary Islands, besides North America.

Family Pyrolaceae. Wintergreen Family. Includes 3 genera and about 20 species, all natives of the northern hemisphere. They are low perennial herbs, usually evergreen, with white or pink flowers, having a 4–5-lobed calyx, a 4–5-parted corolla, stamens twice as many as the lobes, and a several-celled ovary, becoming in fruit a loculicidal capsule. While the corolla is usually quite regular, the style is often declined or bent downward, giving the flower a one-sided appearance. The true wintergreen or checkerberry (*Gaultheria*) oddly enough does not belong to this family, but to the heath family. The *Pyrolas* are round-leaved plants, with flowers in racemes, and leaves all basal. *Moneses*, a monotypic genus, differs from *Pyrola* in having a one-flowered scape. The remaining genus of the family, *Chimaphila*, is known popularly by its original Indian name, "pipsissewa," though it is also called prince's pine. It has leafy stems and white or purplish flowers borne in corymbs rather than in racemes. There are six species, natives of North America, Mexico and Asia.

Family Monotropaceae. Indian-pipe Family. What rambler in the June or July woods has failed to observe the clusters of Indian-pipe just breaking through a mass of sodden and decayed leaves? And what other flower could bear so appropriately the suggestive designation of "corpse-plant?" Its looks certainly do not belie its nature, for in common with all other members of the family it is a saphrophyte, or in other words, a plant deriving its sustenance from decaying vegetable matter, like most of the fleshy fungi. There are about 9 genera and a dozen species in the Monotropaceae, and they are nearly all natives of the northern hemisphere. The flowering scapes are entirely destitute of leaves, bearing only small scales; the whole plant is waxy white, yellowish or red in color. Flowers erect or nodding, with a 2–6-parted calyx and 3–6-parted corolla, which in one California genus is entirely wanting.

The snow plant of the Sierras (*Sarcodes sanguinea*) has been described and figured in THE PLANT WORLD for November, 1900 (IV., Pl. XVIII) and will serve as a good general type of the family.

Family Ericaceae. Heath Family. We pass now to a large group, formerly thought to include all three of the families discussed above, but, as now understood, comprising about 55 genera and over 1000 species. They are herbs, shrubs or trees of very wide distribution, but most abundant in cool latitudes. The flowers may be distinguished by the free, 4–5-parted and usually persistent calyx, and by the regular

4–5-parted corolla. The stamens are equal to, or a multiple of the lobes of the latter, and are hypogynous. The anthers are 2-celled, often tipped with a horn or appendage as in the blueberries. The ovary is 2–5-celled, becoming in fruit a loculicidal or septicidal capsule, a berry or a drupe.

In Europe and Africa, the heaths are among the most conspicuous plants, whole tracts being often covered with a single species. These belong to the genus *Erica*, which is not represented in the New World; but *E. cinerea* and *E. Tetralix* have become sparingly naturalized on the island of Nantucket, along with the Scotch heather (*Calluna vulgaris*). Many South African forms of great beauty are seen in cultivation in European hot-houses.

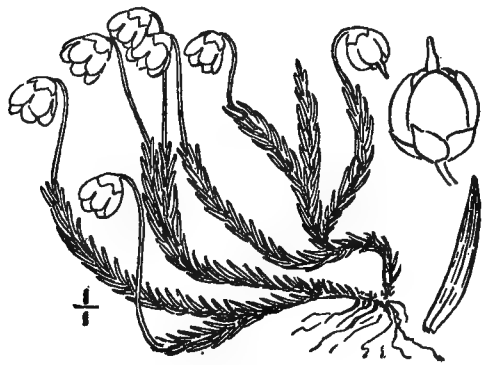


FIG. 179. An American Heath (*Cassiope tetragona*). After Britton and Brown, Ill. Fl. Northeast U. S.

The azaleas and rhododendrons form another extensive group of ornamental plants. They are conspicuous and brilliant along the summits of the higher Alleghenies and also in the Himalayas and Alps. The flowers exhibit a wide range of color, from the purest white to the deepest crimson, and all shades of yellow and orange. Probably our most beautiful azalea is *A. lutea*, the flame azalea, with flowers of a dazzling flame color. In the same class of ornamental shrubs may be ranked the mountain-laurel (*Kalmia*), which often grows with the rhododendron; its flowers are quite different, however, in structure. The ten stamens, when the corolla first opens, are bent back like bows, the anther sacs fitting in little depressions or pockets on the corolla lobes. The slightest touch at the bases of the sensitive filaments by some prowling insect in search of honey causes them to spring back, deluging the visitor with a shower of pollen and thus ensuring cross-fertilization.

In the far northern regions and on the highest mountains the heaths seem to luxuriate, and many of the genera have their exclusive homes

in such regions. Among these may be mentioned *Ledum*, the Labrador tea; *Cassiope*, *Chamaedaphne*, *Phyllodoce* and *Andromeda*. Others are characteristic of the Pacific States, as the madroña (*Arbutus Menziesii*), a handsome tree only distantly related to the beautiful mayflower, which is often incorrectly called arbutus. The mayflower, by the way (*Epigaea repens*), is one of those peculiar plants in which there are but two species, one of eastern North America, the other of Japan. The accompanying plate, taken from a photograph, is an unusually good picture of this dainty little flower.

The economic interest in the Ericaceae centres chiefly in those genera whose fruit is a berry rather than a capsule, as in the blueberries and their allies (*Vaccinium*). The latter genus is represented by a large number of species, most of which have edible fruit. Of less value, but still useful, particularly when cooked, are the huckleberries, derived from species of *Gaylussacia*. The writer is often asked the difference between a blueberry and a huckleberry, and it is true that in many parts of the country, particularly in New England, the terms are used synonymously, and applied indiscriminately to both *Vaccinium* and *Gaylussacia*. As a matter of fact, while the two genera are sufficiently distinct in structural characters, it is hard to draw a line of popular demarcation. Both fruits contain what appear to be seeds, but in *Gaylussacia* they are really one-seeded nutlets, or little stone fruits. There is no color criterion, for while most *Vacciniums* have blue fruits and most *Gallussacias* black, there are exceptions in each of the two genera.

FIG. 180. The Small Cranberry (*Oxycoccus Oxycoccus*). After Britton and Brown, Ill. Fl. Northeast U. S.

The cranberry belongs to the genus *Oxycoccus*, and the cranberry industry is an important one on Cape Cod and in parts of New Jersey. Besides the cranberry of commerce we have one or two wild species. The checkerberry or true wintergreen (*Gaultheria*) produces a fruit that appears to be a true berry, but in reality the fleshy part consists of the enlarged fruiting calyx, enveloping the ovary.

It should be stated that many of the heaths contain toxic alkaloids, rendering their herbage poisonous to stock; and it is on this account that the narrow-leaved laurel of our northern States (*Kalmia angustifolia*) is known as "sheepkill" or "lambkill."

Family Epacridaceae. Australian Heath Family. This group, which is almost exclusively confined to Australia, contains about 32 genera and 350 species, all shrubs or undershrubs of heath-like aspect and entirely replacing the Ericaceae in that region. They differ from the latter in the uniformly 5-parted corolla, the 1-celled anthers without appendages of any sort, and in the attachment of the corolla. Several genera, notably *Epacris*, *Leucopogon* and *Styphelia*, are sometimes cultivated in greenhouses. Some yield edible berries.

Family Diapensiaceae. Diapensia Family. Includes 6 genera, most of which are monotypic, all being natives of the northern hemisphere. They are low shrubs or scapose herbs, with white, pink or purple flowers and simple leaves. The calyx or corolla have their parts in fives; the stamens also are 5, borne on the throat of the corolla. Ovary 3-celled, becoming a 3-valved capsule. Nearly all the genera of this family are interesting on account of their remote or local distribution. Thus *Diapensia* is found around the Arctic circle and on the higher mountains of northern New England; it is a tufted undershrub with solitary white or pink flowers. *Pyxidanthera* or "pyxie," a monotypic genus, occurs in pine barrens, principally in New Jersey; the small evergreen leaves and delicate flowers, borne in profusion at the ends of the branchlets, cause it also to be known as "flowering moss."

Within the last few years florists have been using extensively for winter decoration quantities of large round leaves not unlike those of the water lily, exhibiting beautiful shades of purple and green. These leaves are those of *Galax aphylla*, another plant of this family, the genus being also monotypic. It is common throughout elevated regions in the southern States, producing from a thick rootstock a number of the handsome leaves and in spring a raceme of small white flowers.

Undoubtedly the genus of greatest interest, however, is *Shortia*. Originally described by Dr. Gray from a specimen without flowers, found in the mountains of South Carolina, the plant disappeared absolutely from view, and for many years all the efforts of collectors to redis-

cover it were in vain. Finally, however, one enterprising individual found a supply, which he disposed of at high prices to the herbaria of the world. Since that time it has been introduced into cultivation, and is no longer difficult to obtain, although still rare in the wild state. Another species occurs in Japan.

S. galacifolia, our own species, is a handsome little perennial, with solitary white flowers and round, Pyrola-like leaves.

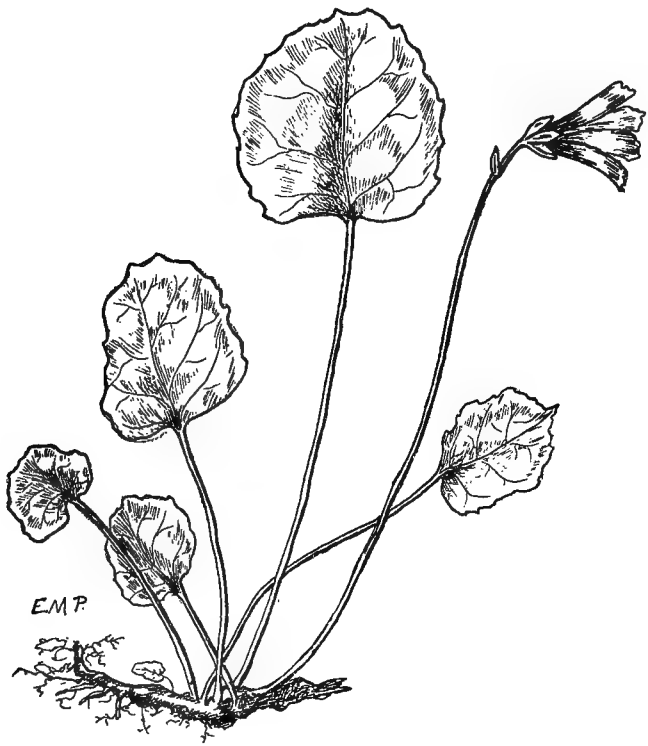


FIG. 181. *Shortia galacifolia*, for a long time considered one of the rarest North American plants. Original.

SUPPLEMENT.

THE FAMLIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXIX.—*Orders Primulales and Ebenales.*

THE Primulales consist of two families, Primulaceae and Plumbaginaceae. The order differs from the Ericales, described in the last chapter, mainly by the position of the stamens, which are borne on the corolla opposite the lobes of the latter instead of being alternate with them. In both families the calyx is free from the ovary.

Family Myrsinaceae. Myrsine Family. Trees or shrubs with coriaceous (leathery) leaves and perfect or occasionally unisexual flowers. Calyx and corolla 4-5-cleft; stamens equal to the corolla lobes and inserted opposite them; ovary 1-celled, becoming a 1-many-seeded, dry or fleshy fruit. There are about 30 genera and 500 species, natives chiefly of tropical regions, and especially abundant, it is said, on islands

Fig. 182. Flowering branch of *Icacorea paniculata*, a Floridian shrub belonging to the Myrsinaceae. Original.

having an equable temperature. Three genera occur in Florida, one of them (*Icacorea paniculata*) being rather an ornamental shrub, with panicles of creamy white flowers. (Fig. 182.) Several species of this genus and of *Myrsine* are cultivated in greenhouses, but the family is not, as a whole, remarkable for economic or other uses.

Family Primulaceae. Primrose Family. Contains about 28 genera and 350 species, widely distributed. All are herbs, with regular flowers, the calyx and corolla each 5-cleft or 5-parted, the stamens also 5. Ovary 1-celled, becoming a 2-6-valved capsule in fruit. There is one genus (*Glaux*) in which the corolla is entirely wanting.

The largest genus is the type of the family (*Primula*), containing

FIG. 184. The Shooting Star (*Dodecatheon Meadia*), considerably reduced. Original.

over 150 species, more abundant in the Old World than in North America. They are scapose, with a tuft of basal leaves and several or many umbelled flowers of many different colors, ranging, moreover, in size from the tiny dwarf Canadian primrose to the stout English cowslip (*P. veris*). An east Asiatic species (*P. obconica*), called the Chinese primrose in cultivation, has furnished many horticultural varieties. The most attractive of our native forms is Parry's primrose,* which is

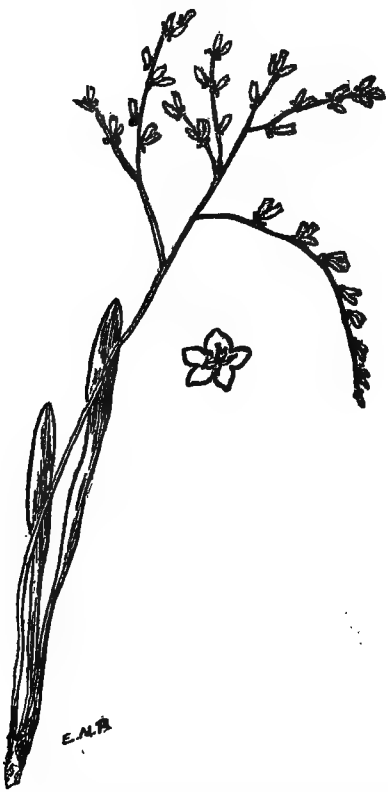


FIG. 185. The Marsh Rosemary (*Limonium Carolinianum*), greatly reduced. Original.

found in abundance throughout the Rocky Mountain region. The yellow loosestrifes (*Lysimachia*) are familiar weeds in our Eastern states. *Cyclamen*, which also belongs to this family, is a well-known greenhouse plant; within the last few years florists have succeeded wonderfully in developing the size and substance of the flowers, and the colors are beautiful, embracing many shades of pink and blush-white. Mention

*See article (with plate) by Dr. F. H. Knowlton, "A Primrose at Home." THE PLANT WORLD, 5: 32. 1902.

should also be made of *Dodecatheon*, a beautiful native genus whose flowers resemble those of the Cyclamen. (See Fig. 184.)

Family Plumbaginaceae. Plumbago Family. Includes about 10 genera and nearly 350 species of wide distribution, a large portion of them maritime herbs. They have usually basal leaves and small clustered flowers, the calyx 5-toothed, its tube many-ribbed, the corolla with 5-clawed segments more or less united at the base. Stamens 5. Ovary 1-celled, but differing from that in the *Primulaceae* by having 5 styles; fruit an achene or utricle.*

Limonium, known as sea lavender or marsh rosemary, is a large genus, the species, however, very close and many of them doubtless intergrading. The numerous flowers, produced in fall, are white or purplish; they are familiar objects on our salt marshes. (Fig. 185.) *Statice*, the sea thrift or sea pink, is mainly of northern distribution. *Plumbago* prefers warmer climates and inland situations; one African species (*P. Capensis*), not uncommon in cultivation, has become extensively naturalized through the West Indies; it has spikes of white flowers with a long slender tube.

The order Ebenales includes the families Sapotaceae, Ebenaceae, Lynplocaceae and Styracaceae. It is hardly distinguishable from the preceding order except in that the plants are all shrubs or trees instead of herbs.

Family Sapotaceae. Sapodella Family. In the groups we have been examining, the various genera and species are useful chiefly from the aesthetic standpoint, having little or no economic value. But the Sapotaceae afford some very important tropical fruits and occasionally good timber. There are about 35 genera and 400 species, represented in our country chiefly by the genus *Bumelia* or buckthorn. In the West Indies there are three well-known fruit trees of this family. The Sapodilla (*Achras Sapota*) has fruit with a custard-like pulp and thick brown skin; its flavor is best when it becomes over-ripe. The Mamey Sapote or Mamey Colorado (*Lucuma Mammosa*) is a large tree with somewhat similar fruit, the flavor being rather less pronounced. One of the most beautiful trees of the tropics is the star apple or caimito (*Chrysophyllum cainito*). It has oblong leaves which are lustrous above and clothed with a velvety yellow pubescence beneath; the leaves catch the sun's rays and transform the tree into a veritable shower of gold. Its fruit is pleasantly flavored.

The seeds of many sapotaceous trees contain oil or vegetable butter in considerable amount. The best example of this class is the so-called shea butter tree (*Butyrospermum Parkii*) of central Africa. The

*A utricle is a dry fruit with a membranaceous exocarp or outer covering.

wood of many is extremely hard and would be valuable in the arts, but as the Sapotaceae are preeminently trees of the virgin forest it is often impossible to utilize them. A kind of gutta percha is derived from *Mimusops Balata* of Guiana. Another species growing in South Florida (*M. Sieberi*) is known as wild sapodilla or " dilly," and the fruit is much prized by children, although it cannot be called of superior quality.

FIG. 186. The Wild Sapodilla (*Mimusops Sieberi*) showing flower cluster and section of fruit, the whole reduced. Original.

Family Ebenaceae. Ebony Family. Contains half a dozen genera and about 280 species, natives of warm climates. They are trees or shrubs, characterized in general by the coriaceous entire leaves, and perfect or unisexual flowers having a persistent 3–7–parted calyx, a 3–7–cleft corolla, and twice or thrice as many stamens. The 3–several-celled ovary becomes a fleshy berry in fruit. The trees of this family yield a hard and valuable wood, ebony being the product chiefly of an East Indian species of persimmon (*Diospyros*). Another species of the same genus affords the variegated Calamander wood of Ceylon. The edible fruit of *Diospyros* is familiar to every one who has lived in a persimmon region, and particularly to the luckless individuals (and their name is legion!) who have ventured to taste the attractive orange-colored berries before the frost has induced a partial decay. The Japanese persimmon (*D. Kaki*) is much larger and superior in flavor to our own.

Family Symplocaceae. Sweet-leaf Family. Trees or shrubs with broad entire leaves and mostly perfect, clustered flowers. Calyx-tube

adnate to the ovary, 5-lobed above. Corolla 5-parted. Stamens very numerous, the filaments somewhat united at the base of each corolla-lobe. Ovary 2–5-celled, becoming a small 1-seeded drupe. The family consists only of the genus *Symplocos*, with about 175 species, natives of tropical regions and particularly abundant in tropical America. A single species, *S. tinctoria*, occurs in the southern United States; it is a pretty shrub, with large green leaves and bright yellow flowers. In Brazil an infusion of the leaves of some species is used as tea; nearly all contain a coloring matter or dye, as may be seen by the fact of the leaves turning yellow in drying.

Family Styracaceae. Storax Family. These also are shrubs or trees with regular, mostly perfect flowers, the calyx-tube partly adnate to the ovary and 4–5-cleft. Corolla 4–8-lobed, the lobes sometimes distinct, making it polypetalous. Stamens 8–10 or more, borne on the corolla, the filaments united at base. Ovary 2–5-celled, becoming in fruit a berry or a dry drupe, occasionally winged. The family contains about 7 genera and 75 species, mainly of the tropics.

Mohrodendron contains two species of exceedingly ornamental small

FIG. 187. The Silver-bell Tree (*Mohrodendron Carolinum*), showing flowers and fruit, reduced one-half. Original.

trees, natives of the southern states, and known as "silver bell" trees from the campanulate, snowy-white corolla. *M. dipterum* has a 2-winged, and *M. tetrapterum* a 4-winged, fruit. (Fig. 187.) There are also several native species of *Styrax*, which are also handsome shrubs; the flowers are usually very pubescent in this genus.

Storax is a balsamic resin derived from *S. officinale*, a native of the Levant. It is obtained by submitting the bark to heavy pressure, and was formerly extensively used by perfumers and also in medicine. Of late it has been supplanted by the product of the Asiatic sweet gum, *Liquidambar orientalis*. *Styrax Benzoin* yields the benzoin of commerce, which is still employed in the manufacture of perfumes and in medicine for pulmonary troubles.

CHAPTER XXX.—*Order Gentianales.*

This group contains the seven families: *Oleaceae*, *Salvadoraceae*, *Loganiaceae*, *Gentianaceae*, *Menyanthaceae*, *Apocynaceae* and *Asclepiadaceae*. The plants comprised in it may usually be distinguished by their opposite leaves, regular flowers with nerved corollas, stamens as many as the corolla-lobes and alternate with them (or fewer), and by the two distinct ovaries or 2-celled single ovary. The order as a whole is medicinal; it contains some useful, and not a few ornamental, plants.

Family Oleaceae. Olive Family. About 21 genera and 500 species, widely distributed. They are trees or shrubs with simple or pinnate leaves and 2–4-parted flowers, having the ovary superior and free from the calyx. In one genus (*Adelia*) and in many species of another (*Fraxinus*) the corolla is wanting. The fruit may be either a capsule, a samara (Key-fruit, like that of the maple) a berry or a drupe.

Olea Europea, the olive, is widely cultivated throughout Southern Europe, and is of considerable economic importance. It also thrives in Southern California. The fruit is a true drupe, consisting of a hard stone or endocarp, surrounded by a fleshy exocarp. The familiar lilac belongs to the genus *Syringa*, which affords another example of faulty popular nomenclature. The plant to which the name syringa is universally applied, namely, the mock orange (*Philadelphus*) belongs to an entirely different family, and neither resembles, nor is in any way related to the lilac. *Fraxinus*, the ash, contains numerous species in Europe and America, most of which are handsome trees, with clean foliage, and very popular for park planting. One of the most beautiful of our native shrubs, the fringe-tree (*Chionanthus*) also belongs to this family. (Fig. 188.)

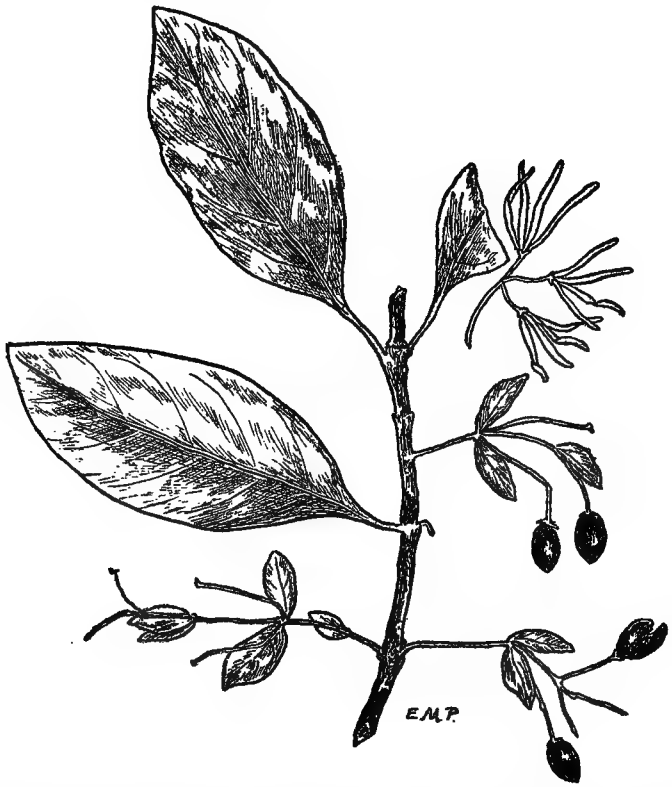


FIG. 188. The Fringe-tree. (*Chionanthus Virginica*), reduced one-half. Original.

Fig. 192. The Common Milkweed (*Asclepias Syriaca*).
After photograph by Carl Krebs.

Fig. 194. The Common Morning-glory (*Ipomoea purpurea*).
After photograph by Carl Krebs.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXX.—*Order Gentianales, Continued.*

FAMILY SALVADORACEAE. A group of small trees belonging to five or six species, all comprised in the genus *Salvadora*. They resemble the Oleaceae in most particulars, having opposite leaves, and small panicled flowers with a 4-cleft calyx and corolla, 4-parted stamens and a 1-celled ovary. They are natives of northern and central Africa and southwestern Asia.

Salvadora Indica is supposed to be the plant referred to as mustard in the New Testament, and which, as St. Matthew says, "is the least of all seeds; but when it is grown it is the greatest among herbs, and becometh a tree, so that the birds of the air come and lodge in the branches thereof." As the fruit is pungent and mustard-like, there seems be some ground for the belief.

Family Loganiaceae. Logania Family. Contains about 30 genera and 400 species, widely distributed in warm and tropical regions. They are herbs, shrubs, vines, or occasionally trees, with opposite stipulate leaves, and regular 4–5-parted flowers, the ovary free from the calyx and 2-celled. The stamens are borne on the throat of the corolla and are equal in number to its lobes. Fruit a 2-valved capsule, or a berry. The plants of this family all possess bitter and poisonous properties. Strychnine, one of the most deadly of vegetable alkaloid poisons, is derived from *Strychnos Nux-vomica*, an East Indian tree, while the poison known as wourali, used by natives of Guiana for poisoning their arrow tips, is obtained from *S. toxifera*. Strangely enough, the pulp surrounding the seeds in many species of *Strychnos* is edible, and it is only the seeds themselves that are so highly poisonous (Fig. 189).

In our country the Loganiaceae are represented chiefly by the beautiful climbing shrub known as the southern yellow jessamine (*Gelsemium sempervirens*). The bright yellow flowers of this constitute one of the most prominent features in the spring landscape of our southern States. There are also a number of insignificant weeds belonging to the family.

Family Gentianaceae. Gentian Family. Distinguished from the preceding by the entire absence of stipules to the leaves, and the single-

Fig. 189. The Paintroot (*Spigelia Marylandica*) one-half natural size. Original.

celled, instead of 2-celled, ovary. There are about 65 genera and 600 species in this family, and they are very widely distributed. The plants are mostly glabrous herbs, possessing bitter properties, many of them valuable in the pharmacopoeia. The corolla is frequently persistent after withering; it is succeeded by a 2-valved capsule.

The genus *Gentiana* embraces a large number of species, differing widely in habit and in the color of their flowers. Many of them are natives of alpine or mountainous regions, with flowers of great size and beauty in proportion to the size of the plant. In the United States, two of the most beautiful species are the western fringed gentian (*G. elegans* Greene) and the pine-barren gentian (*G. Porphyrio*), the latter being particularly abundant throughout southern New Jersey (Fig. 190). In the southern States the gentians are mostly replaced by species of *Sabbatia*, which have pretty white or pink flowers.

Family Menyanthaceae. Buckbean Family. These are perennial or marsh herbs, formerly included in the Gentianaceae, but now sepa-

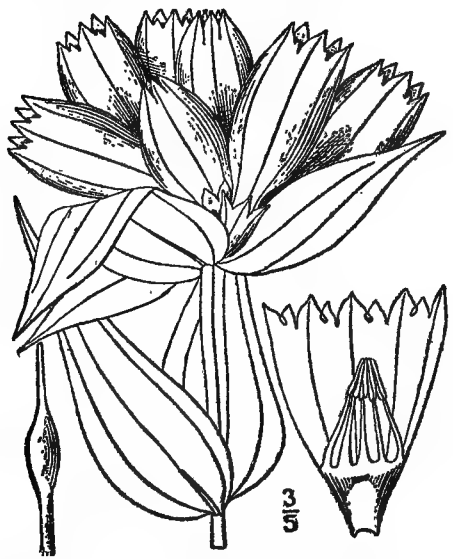


FIG. 190. The Yellow Gentian (*Gentiana flavida* Gray). After Britton and Brown, Ill. Fl. Northeast. U. S.

rated from that family on account of their habit, their basal or alternate leaves, and the different position of the corolla-segments in the bud. There are 5 genera and about 35 species, widely distributed. The buckbean (*Menyanthes trifoliata*) is a familiar denizen of our northern bogs; it has a rather handsome spike of white flowers. *Limnanthemum* includes a number of floating aquatics with leaves somewhat suggesting those of the water lily, and white or yellow flowers. *L. nymphaeoides*, of Europe, is occasionally cultivated for ornament.

Family Apocynaceae. Dogbane Family. Consists of herbs shrubs, or in some tropical genera, trees, with an acrid and usually poisonous milky juice. The leaves are simple, and the flowers regular and 5-parted, the corolla often twisted, a fact which led Linnaeus to give the name Contortae to the group. The stamens are equal in number to the corolla-lobes, and inserted on the throat alternating with them; the ovary is superior, 1-celled or with two distinct carpels; the fruit consists of two follicles, resembling those of milkweeds, or drupaceous. There are about 130 genera and 1,050 species in this widely distributed family. It is most abundantly represented, however, in tropical regions. The dogbanes are an important group, whether considered from the economic or other standpoint. As has been stated, their juice is ordinarily very poisonous; but in some instances it has medicinal value, while in a few genera (*Vahea* and allies) it yields a fair quality of caoutchouc. A number of important fiber plants are also contained in the family; and in a

FIG. 191. The Indian Hemp or Dogbane (*Apocynum cannabinum*).
(After Dodge, Rep't. No. 9, U. S. Dept. of Agric.)

few instances the fruits are edible. Many climbing shrubs, like *Allamanda* and *Echites*, have handsome flowers, and are familiar in greenhouse cultivation.

The principal representative in our territory is the genus *Apocynum*, known as dogbane. It has rather attractive small pink flowers, succeeded by long narrow fruits with winged seeds. *A. cannabinum*, one of the plants called Indian hemp, furnishes a good tough fiber (Fig. 191).

Several very poisonous trees of the Apocynaceae are of interest as being " ordeal trees." The most familiar of these is the tanghin, *Tanghinia venenifera*, confined to Madagascar. The natives use the seeds in the trials of evil-doers, forcing each culprit to swallow a portion. In case the seed is retained in the stomach it proves immediately fatal, and guilt is then considered established. If on the other hand it is vomited,

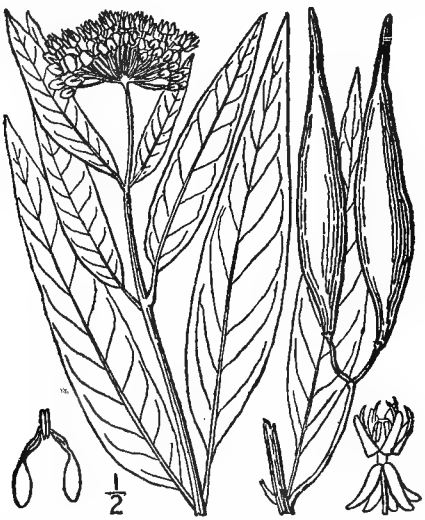


FIG. 193. The Swamp Milkweed (*Asclepias incarnata*). After Britton and Brown, Ill. Fl., Northeast, U. S.

recovery usually ensues, and the prisoner is released as innocent. In Polynesia *Cerbera* is used in a similar manner.

Family Asclepiadaceae. Milkweed Family. Contains about 220 genera and 1,900 species, of wide distribution. They are herbs, vines or shrubs, with milky juice, and flowers borne usually in umbels. The corolla and calyx are 5-parted; between the corolla and stamens is a 5-parted body, known as a crown or corona. The pollen is coherent in masses, as in the orchids, and exhibits many interesting adaptations to cross-fertilization through insect agency. The ovary consists of two carpels, which become follicles in fruit; the seeds are usually appendaged with a long tuft of hair or coma. The milkweeds proper (*Asclepias*) are among our most showy wild flowers; the different species exhibit orange, yellow, pink, purple and white flowers (Figs. 192 and 193). In the desert regions of northern Africa there are a number of leafless succulent plants belonging to this family; these, with *Euphorbias* of similar habit, replace the cacti of our western plains. The juice is often poisonous, like that of the dogbanes, but in some cases it possesses valuable emetic and purgative properties. The family is very widely distributed, but is particularly abundant in South Africa.

CHAPTER XXXI.—*Order Polemoniales or Tubiflorae.*

This order consists mainly of herbs. It embraces twenty families, of which the most important are the Convolvulaceae, Polemoniaceae, Hydrophyllaceae, Boraginaceae, Verbenaceae, Labiatae, Solanaceae, Scrophulariaceae, Bignoniaceae and Acanthaceae. The corolla is gamopetalous throughout, with the stamens more or less united with its tube. The ovary is superior and compound.

Family Convolvulaceae. Morning-glory Family. Contains about 40 genera and nearly 1,000 species, of wide distribution. They are herbs or vines, rarely shrubs or trees, with alternate leaves and axillary flowers. The calyx is usually persistent, the 5-angled or 5-lobed corolla convolute (twisted) in the bud. Stamens, 5; ovary, 2-3-celled, becoming a 2-4-valved capsule.

The two most important genera, *Convolvulus* and *Ipomoea* are highly esteemed as furnishing many ornamental vines. In fact, there is probably no genus in which the species are more uniformly handsome-flowered throughout than the *Ipomoea,* to which the common morning-glory belongs. (Fig. 194). The leaves are of every conceivable shape and degree of lobation, while the flowers exhibit a great variety of colors, particularly in the tropics. The beautiful white moonflower, formerly included in *Ipomoea,* is now usually placed in a distinct genus (*Calonyction*). The Convolvulaceae are of very slight economic importance; the gum-resin known as scammony, is produced by *Convolvulus Scammonia,* while the purgative drug jalap is yielded by a species of *Ipomoea.*

Family Cuscutaceae. Dodder Family. These are leafless parasitic twining vines, all comprised in the single genus *Cuscuta,* of which there are about 100 species, of wide distribution. The calyx and corolla are 5-lobed or 5-parted, the coralla-lobes frequently bearing scales alternate with them. The stamens are 5; ovary 2-celled, becoming a 1–4-seeded capsule.

The seeds of the dodder germinate in the ground like those of ordinary plants, and the young seedling soon attaches itself by means of numerous minute suckers to the adjacent herbage. When it has obtained a sufficient hold to enable it to secure the required amount of nutrition its root and lower portion perish. When fully grown it resembles a mass of white or orange-colored tangled threads spread over the foliage of the herbs on which it is found. While some species, like *C. Gronovii,* are quite cosmopolitan in their tastes, occurring on a variety of plants, others, like *C. Trifolii,* are confined strictly to one kind of plant.

Family Polemoniaceae. Polemonium Family. This group, consisting entirely of herbs, includes about 10 genera and 200 species, by

far the most of which are found in the western United States. They have clustered, usually handsome, flowers, the calyx and corolla 5-cleft or 5-parted, the lobes twisted or contorted. Stamens 5, the anthers versatile (attached by the middle); ovary 3-celled, with 3 stigmas, becoming in fruit a 3-valved capsule. The seeds are peculiar, in some cases being winged, and in others enveloped in mucilage and having the property of emitting spiral tubes when wetted.

This family includes the large genus *Phlox*, which affords so many ornamental annuals and perennials to our flower beds; scarcely less pleasing are the *Gilias*, of which there is an enormous number of species in California. *Polemonium* is represented most abundantly in Alaska

Fig. 195. Eastern Polemonium, or Jacob's Ladder (*Polemonium Vanbruntiae*). One-half natural size. Original.

and the Rocky Mountains, but there are one or two eastern species (Fig. 195). Another familiar garden plant is the exotic climbing vine, *Cobœa scandens*. The Polemoniums, as a rule, possess medicinal properties.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXX.—*Continued.*

FAMILY HYDROPHYLLACEAE. Waterleaf Family. Contains about 17 genera and 160 species, very widely distributed. The plants are herbs, with variously shaped and usually alternate leaves. The flowers, which are nearly always blue in color, are arranged in one-sided spikes or racemes called *scorpioid* from the fact that they are curved like a scorpion's tail, gradually straightening as the flowers bloom. The calyx and corolla are 5-parted or 5-cleft, the stamens of like number and inserted on the throat of the corolla, alternating with its lobes. Ovary superior, 2-celled with 2 styles; fruit capsular, 2-valved.

The name Waterleaf, which is a literal translation of the name of the typical genus (*Hydrophyllum*) is supposed to refer to the water cavity in each leaf. (Fig. 196.) The Hydrophyllums are common plants in

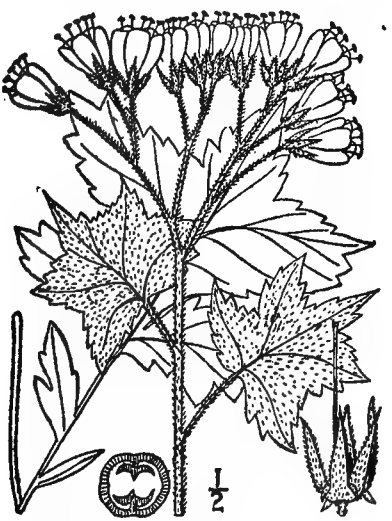


Fig. 196. The Waterleaf (*Hydrophyllum appendiculatum*). After Britton and Brown, Ill. Fl. Northeast U. S.

rich woods; they have large pinnatifid or pinnate leaves and white or blue, rather large flowers. The genus *Phacelia* embraces about half the species in the family, the majority of them occurring in the western half of the United States. They are hairy herbs, with blue, purple or white flowers in terminal clusters. In some of the species the corolla is beautifully fringed. *Nemophila*, a genus mainly of Californian distribution, contains species that are in common cultivation as garden annuals.

Family Boraginaceae. Borage Family. This large group differs from the preceding chiefly in the structure of the fruit. The ovary consists of two distinct carpels, each of which are 2-celled, but they are often lobed so as to appear 1-celled. The fruit consists, therefore, of 2 or 4 one-seeded nutlets. The plants are herbs, shrubs, or in some tropical genera trees, comprised in 85 genera and 1500 species, very widely distributed, though most abundant in temperate latitudes. In the tropics, with the exception of a few kinds of heliotrope (*Heliotropium*), the family is represented only by trees and shrubs of the genera *Cordia*, *Tourne-*

Fig. 197. The Houndstongue (*Cynoglossum officinale*). Original: reduced one-half.

fortia, and a few relatives of these. Our western plains and the drier regions of southern Europe and Asia, on the other hand, abound with bristly-hairy herbs of the Borage family. In general, they possess mucilaginous qualities, and quite a number yield dyes, as the alkanet (*Alkanna tinctoria*). A few are occasionally used as potherbs, like the comfrey (*Symphytum officinale*) or as salads (*Borago officinalis*). Very few can be considered ornamental, with the exception of the heliotropes and some species of *Myosotis* (forget-me-not). Some of the European genera, such as the blueweed (*Echium vulgare*) have become extremely troublesome weeds in certain parts of our eastern States. The seeds of many of these plants are curious, being very hard and stone-like in texture, (whence the name *Lithospermum*, applied to one genus,) and often polished white and shining. Fig. 197 shows the fruit of the common houndstongue (*Cynoglossum officinale*) which belongs to the class of "stick-tights," being beset with viscid bristles. Fig. 198 is a flowering

FIG. 198, White Cordia (*Cordia alba*). Original; reduced one-half.

branch of the tree *Cordia alba*, commonly cultivated for ornament in the West Indies.

Family Verbenaceae. Verbena Family. These are herbs, shrubs,

or occasionally trees, comprised in about 70 genera and 1200 species of wide distribution. They have opposite or whorled, rarely alternate leaves, and perfect but usually irregular flowers, variously clustered. Calyx 4–5-lobed. Corolla bilabiate (2-lipped) or sometimes regular,* with a slender tube and 4–5-cleft upper portion. Stamens 4, one pair longer than the others, or rarely 2; ovary superior, 2–4-celled, composed of 2 carpels; fruit dry, consisting of 2–4 nutlets, or fleshy, a 2–4-seeded drupe.

The verbena of our gardens, belonging to the genus *Verbena*, is a characteristic plant of this family. Besides the ornamental species of cultivation having the corolla of many colors, there are many wild species of *Verbena*, known as vervains, which are decidedly weeds, having small, insignificant flowers in long spikes. (See Fig. 199.) *Lippia* is some-

FIG. 199. The Blue Vervain (*Verbena hastata*). After Britton and Brown, Ill. Fl. Northeast U. S.

what similar in its characters to *Verbena;* it is very widely represented in the tropics, as is also *Lantana*, familiar to us as a greenhouse shrub. The black mangrove (*Avicennia nitida*), common on the Florida Keys, and remarkable for its habit of sending up from the ground short erect roots, is a tree of this family. The so-called "lemon verbena" belongs to the genus *Aloysia*. The teakwood of East India (*Tectona grandis*) is one of the most important Oriental timber trees. Other East Indian genera, sometimes represented in cultivation, are *Vitex* and *Clerodendron*.

Family Labiatae. Mint Family. This very large and important

*The flat, expanded part of a corolla like that in a phlox flower, is known as the *limb* in contra distinction to the *tube* below.

group consists of about 160 genera and 3000 species, of very wide distribution. They are herbs or shrubs, rarely trees, with highly aromatic herbage, and may be recognized usually by the square stems and opposite leaves. The calyx is 5-toothed or 5-lobed, mostly nerved; the corolla with a 4–5-lobed limb, but mostly bilabiate. Stamens 4, in two sets, or 2. Ovary superior, 4-lobed, becoming in fruit 4 one-seeded nutlets, one of the important characters of the family.

The Labiatae include all of our familiar wild and garden mints, such as balm, savory, sweet basil, sweet marjory, thyme, hyssop, lavender, pennyroyal, bergamot and the like. While the majority of the mints used for economic and officinal purposes are of Old World origin, we have many genera and species in the United States. There is space merely to mention a few of the more important forms. *Mentha* (See Fig. 200) is the type of the family, and furnishes us with peppermint (*M.*

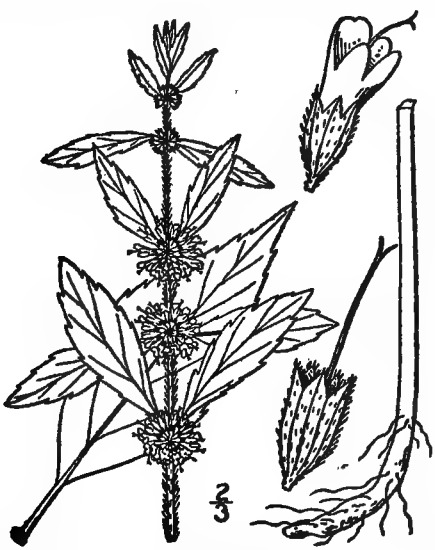


FIG. 200. American Wild Mint (*Mentha Canadensis*). After Britton and Brown, Ill. Fl. Northeast U. S.

piperita) and spearmint (*M. spicata*). The flowers are in close whorls at the axils of the leaves, or are aggregated in a terminal spike. *Monarda* contains some very handsome species, notably *M. didyma*, the bee balm, with scarlet flowers; *M. fistulosa*, the wild bergamot (See Fig. 201) with pink or purple flowers, and *M. punctata*, the horse balm, with yellowish, spotted flowers. The very large genus *Salvia*, or sage, chiefly tropical in distribution, furnishes us with common sage, valuable in seasoning, and with the splendid scarlet-flowered species that give color to our flower beds in the late summer. *Coleus*, well-known as an ornamental foliage

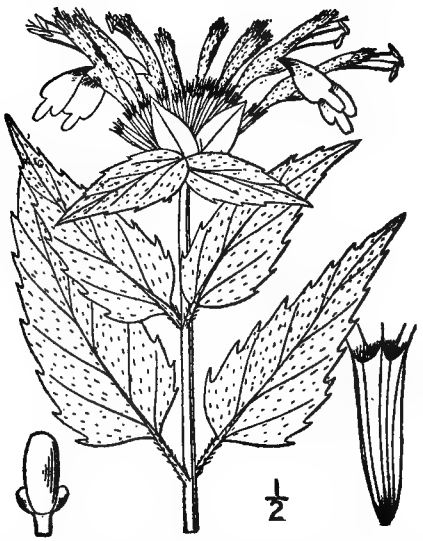


FIG. 201. The Wild Bergamot (*Monarda fistulosa*). After Britton and Brown, Ill. Fl. Northeast U. S.

plant, belongs with the mints, as does also the little ground ivy (*Glecoma*). The Pacific Coast has a number of ornamental species in *Ramona*, *Stachys* and *Monardella*. The largest flowered of our eastern mints are found in *Physostegia*, the false dragon-head. The general type of labiate flower is shown in Fig. 202.

Family Nolanaceae. Nolana Family. Consists of about 40 species, comprised in the single genus *Nolana*, which was formerly included in the Solanaceae. They are South American herbs or undershrubs, with rather pretty flowers, very similar in structure to the nightshades.

Family Solanaceae. Nightshade Family. Includes about 70 genera and 1600 species, most abundant in the tropics. They are herbs, shrubs or vines, or rarely trees, with usually alternate leaves and cymose flowers. The calyx and corolla are 5-lobed, the latter with the lobes plicate (folded) in the bud. Stamens as many as the lobes of the corolla and alternate with them, all equal except in one genus. Ovary superior, 2-celled, becoming in fruit a berry or a capsule with numerous seeds.

The family, as a whole, possesses strongly narcotic and poisonous properties. These are particularly prominent in *Atropa*, which yields the drug belladonna; in *Hyoscyamus*, the henbane; and in many species of *Solanum* or nightshade. The latter is the largest genus of the family, containing fully 900 species, exhibiting a wide variety of form and uses. The most important from the economic standpoint is the potato (*Solanum tuberosum*), the tubers of which lose their poisonous principle by

FIG. 202. Flowering branch and enlarged flowers of a typical labiate plant (*Teucrium*). After Coulter's "Plant Structures," by courtesy of D. Appleton & Co.

cooking, and become one of our most nutritious vegetables. In Japan the fruits of *S. album* and *S. Aethiopicum* are used as food, and in South America and Australia, other species are employed for the same purpose. Several species, such as *S. indigoferum*, are cultivated for the sake of the dyes which they yield. Many of the nightshades are disagreeable weeds, particularly in warm latitudes; in this category may be mentioned the horse-nettle (*S. Carolinense*) and the black nightshade (*S. nigrum*). A few species, as *S. Seaforthianum*, are cultivated for their flowers.

The tomato belongs to the allied genus *Lycopersicum*, and has been wonderfully developed in the hands of horticulturists. The ground-cherry or ground-tomato, belongs to the rather large genus *Physalis*.

A number of ornamental plants, such as the *Petunia*, the *Datura* and species of *Cestrum* belong to the family. *Datura* includes also the familiar "jimson-weed" of our southern States (see Fig 203); though

FIG. 203. Jimson-weed (*Datura Stramonium*): a. flower and leaf; b, fruit; both one-third natural sizes. (After Chesnut, Bull. No. 20, Div. of Bot. U. S. Dep't of Agric.)

certainly a troublesome weed, it is not altogether without its uses, as the leaves enter into nearly all preparations for the cure of asthma.

Not the least important member of the family is the genus *Nicotiana*, the tobacco. There are a number of wild species, but the tobacco of commerce is chiefly derived from *N. Tabacum*.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXX.—*Continued.*

FAMILY Scrophulariaceae. Figwort Family. These plants are herbs, shrubs or occasionally trees, having perfect but usually somewhat irregular flowers. The calyx is persistent, 4–5-divided, and sometimes irregularly cleft. The corolla is usually 2-lipped; the stamens are 2, 4 or 5, occasionally nearly equal, but more often in two sets of different lengths (didynamous) and inserted on the corolla. Pistil entire or 2-lobed; ovary superior, 2-celled or rarely 1-celled, becoming in fruit a capsule with numerous seeds. The family contains about 165 genera and 2500 species of very wide distribution.

Although very close in appearance and structure to some of the related families, the figworts can be distinguished, technically, by their albuminous seeds. One tribe is indeed so close to the nightshades that it can only be separated by a finely drawn arbitrary line. By some writers the family has been divided into groups according to the arrangement of the corolla-lobes in the bud. Thus the Salpiglossideae, containing the showy garden plants of the genera *Salpiglossis*, *Browallia* and *Schizanthus*, has the corolla plaited, with the two upper lobes outside. Another large group contains the snapdragons and their allies, and is distinguished by having a 2-lipped corolla bearing a fancied resemblance to the human face in some of the genera, such as *Antirrhinum*, the garden snapdragon, and *Linaria*, which includes the wild toadflax or "butter-and-eggs." The corolla of the latter bears in addition a long spur. This tribe is a very large one, containing many highly ornamental herbs. Such genera as *Pentstemon* and *Mimulus*, countless species of which grow wild in our Western States, exhibit many horticultural varieties, with flowers of showy coloration (See Fig. 204). The familiar mullein (*Verbascum*), of which there are numerous European species, is perhaps the only common weed of this group.

The next group has the corolla imbricate in the bud and the upper two lobes always inside, and it is scarcely at all bilabiate. Here we find the genus *Gerardia*, whose attractive pink and white flowers are conspicu-

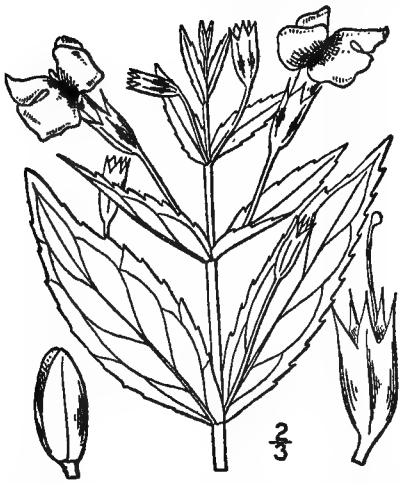


FIG. 204. Monkey-Flower (*Mimulus ringens*). After Britton and Brown, Ill. Fl. Northeast U. S.

ous features of the fall landscape, particularly in rather dry situations. The false foxglove (*Dasystoma*) was formerly included in the genus *Gerardia*, but is distinguished by its yellow flowers. There are several peculiar features about the Gerardias and their allies. In the first place they are all partial root parasites, deriving a portion of their sustenance from the roots of other plants, a fact that renders it difficult to transplant them. In addition they have the singular property of turning completely black during the ordinary process of drying.

Another large genus of the same group is *Veronica*, which includes the common speedwells, low herbs with flowers of different colors, some found as weeds in the lawn and meadow, others growing along brook sides, whence they are called "brooklime". The louseworts (*Pedicularis*) are most abundant in arctic and alpine regions. They have a peculiarly shaped corolla known as galeate, from the resemblance of its upper lobe to a helmet. (See Fig. 205.)

A number of the plants belonging to the Scrophulariaceae possess strongly marked medicinal properties. Thus the European foxglove (*Digitalis*) contains an intensely poisonous alkaloid called digitalin, but in small doses it is a valuable heart stimulant. The genus *Scrophularia*, type of the family, derives its name from the property which the roots were supposed to possess for curing scrofula. *Euphrasia*, a large Old World genus, is known as eye-bright, from its use, both externally and internally, in complaints of the eyes.

Mention has already been made of most of the ornamental genera, but the handsome tree *Paulownia imperialis* should not be overlooked.

FIG. 205. Wild Lousewort or Wood Betony (*Pedicularis Canadensis*). After Britton and Brown, Ill. Fl. Northeast U. S.

This is the only Scrophulariaceous tree seen in temperate climates; it bears large pyramidal clusters of lilac-purple flowers, succeeded by ovoid capsules which are persistent on the tree through the winter. It is commonly planted in our parks, and escaped in many places. It is a native of China and Japan.

Family Bignoniaceae. Bignonia Family. Consists of climbing shrubs or trees, with usually opposite compound leaves and showy flowers. Calyx 4–5-toothed, sometimes completely cleft on one side, forming a sort of spathe. Corolla 4–5-lobed, somewhat irregular. Stamens 5, unequal, one or two generally abortive. Ovary 2-celled, becoming in fruit a 2-celled, pod-like capsule; seeds numerous and winged.

There are about 50 genera and 450 species in this family; they are found principally in the tropics of both hemispheres, but predominate in the eastern. In equatorial jungles they constitute a large part of the so-called "lianas," which are flexible, woody vines, whose rope-like stems form loops in all directions, clambering over the tall forest trees and making progress impossible.

There are many genera, like *Bignonia*, whose showy flowers render them desirable for greenhouse cultivation. Two species of *Bignonia* and two of *Tecoma* are found within our borders, in the Southern States. The tropical calabash tree (*Crescentia*) with large, gourd-like fruits, used for dishes and water-bottles, belongs to this family.

Family Pedaliaceae. Sesame Family. This is not a large group, containing only about 10 genera and 25 species. The plants are annual or perennial, with simple leaves and rather large axillary or clustered flowers. The calyx and corolla are each 5-lobed, the latter nearly regular; stamens 4, didynamous, with an abortive or rudimentary fifth one; ovary 1-celled, becoming a rather hard capsular fruit of variable shape. The family is confined to the tropics, being most abundant in Africa. Seeds in most of the genera are decidedly mucilaginous; this is particularly true of sesame (*Sesamum Indicum*) whose seeds, known in the West Indies as "benny seeds," yield a fixed oil, and are much used in making cakes and confectionery; the oil is also used as an adulterant for olive and almond oil.

Family Martyniaceae. Martynia Family. This curious family, consisting of a single genus, with about 12 species, was formerly included in the preceding, from which it is abundantly distinguished by the irregular flowers, and the fruit, which is tipped with two long curved beaks or horns, whence it is sometimes called the unicorn plant. The species are all tropical American, and one occurs as an escape as far north as New York City. Several species are in garden cultivation, both for their interesting flowers, and for the young fruit, from which very good pickles can be made.

Family Orobanchaecae. Broom Rape Family. Contains about 11 genera and 200 species, of wide distribution. They are all root parasites, practically leafless, the leaves being reduced to small appressed scales; the flowers are perfect and irregular, either solitary or in terminal spikes. Calyx 4-5-toothed, or cleft on one or both sides. Corolla 5-lobed, 2-lipped. Stamens 4, didynamous, with the rudiment of a fifth present. Ovary 1-celled, becoming a 2-valved capsule with numerous seeds.

The broom-rapes startle us by the ghostly spontaneity with which they spring up in unexpected places. They are usually of one color throughout, and the effect is sometimes rather pleasing. Thus the small naked broom-rape (*Thalesia uniflora*) has a solitary long-peduncled flower, and is pale lilac throughout. It grows rather abundantly in the spring in moist woods. Squaw-root (*Conopholis*), on the other hand, is found in dense tufts at the bases of trees; it has the yellowish flowers in stiff spikes. Plants of this family possess tonic and astringent properties, and have occasionally been used in medicine.

Family Gesneraceae. Gloxinia Family. About 100 genera and 800 species, natives exclusively of the tropics, and particularly abundant in South America. They are herbs or shrubs, frequently with tuberous roots; the wrinkled leaves are opposite, and the flowers are nearly always showy. Calyx 5-parted; corolla 5-lobed, somewhat irregular;

stamens 2 or 4, the anthers sometimes united. Ovary 1-celled, surrounded by glands at the base. Fruit 1-celled, dry or succulent.

The chief interest attaching to this family lies in their value as ornamental plants for the greenhouse, most of them, such as *Gloxinia*, *Gesnera*, *Achimenes*, etc., take kindly to cultivation and many beautiful varieties have been developed from the original species.

Family Columelliaceae. Columellia Family. Consists only of the genus *Columellia*, with several Peruvian species. They are evergreen shrubs related to the Gesneraceae, but the flowers are remarkable in having the two anthers with enormously elongated cells, which coil upon themselves and form a globular mass.

FIG. 206. Greater Bladderwort (*Utricularia vulgaris*). After Britton and Brown, Ill. Fl. Northeast U. S.

Family Lentibulariaceae. Bladderwort Family. These are marsh terrestrial or aquatic herbs, with perfect irregular flowers having a 2–5-parted calyx, and a 2-lipped corolla, the upper lip 2-lobed, the lower 3-lobed and spurred. Stamens 2; ovary 1-celled, capsular in fruit. There are 4 genera and about 180 species; the two important genera are *Utricularia* and *Pinguicula*. The former comprises the three bladderworts, most of which are immersed or floating aquatics with finely cut foliage, supported by small inflated bladders, and erect scapes of pink or yellow flowers. (See Fig. 207.) *Pinguicula* is common in the pine barrens of

FIG. 207. Another view of the bladderwort (*Utricularia*) showing the air bladders by which the plant is floated. After Kerner, from Coulter's "Plant Relations," by courtesy of D. Appleton & Co.

the south, and the species are found in extreme arctic regions as well; they are called butterworts, from the slippery surface of the leaves, which are borne in a basal tuft or rosette.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXX.—*Continued.*

FAMILY GLOBULARIACEAE. Globularia Family. A small group of herbaceous or shrubby plants, natives of both shores of the Mediterranean, having flowers borne in a head and surrounded by an involucre, a character from which the name of the principal genus is derived. The calyx is 5-parted; the corolla tubular, 5-lobed and somewhat 2-lipped; stamens, 4. Ovary free, one-celled, becoming in fruit an achene, closely invested by the persistent fruiting calyx. There are 3 genera, *Globularia*, with 17 species, *Lytanthus*, with 2, and *Cockburnia*, with 1.

Family Acanthaceae. Acanthus Family. Herbs, shrubs, or rarely trees, with opposite leaves and irregular or nearly regular flowers. Calyx 4–5-parted. Corolla 5-lobed, frequently 2-lipped. Stamens 2 or 4, in the latter case didynamous. Ovary free, 2-celled. Capsule 2-celled, loculicidally 2-valved. The family contains about 175 genera and 1800 species, widely distributed in warm temperate and tropical regions. Many are mere weeds, but some are ornamental plants. The Old World genus *Acanthus* has served for centuries as a pattern for art designs; the leaves of *A. spinosus* are said to have furnished to Callimachus the model for the Corinthian capital in architecture.

Fig. 208. A native Acanthaceous weed, *Diapedium assurgens*. Original. About one-third natural size.

Our native plants of this family are few in number. Ruellias, of several species, low herbs with purple flowers, are rather common plants of the late summer. The water-willow (*Dianthera*) grows in large masses on the edges of ponds and streams, its speckled flowers being exceedingly irregular. In the greenhouse we find numerous handsome species of *Justicia* and *Aphelandra*. Most of the Acanthaceae contain a bitter principle, and some few are of value in medicine. (See Fig. 208.)

Family Myoporaceae. Myoporum Family. A group of shrubs, natives chiefly of Australia, comprised in about 5 genera and 80 species. They

have a 5-parted, persistent calyx; a more or less 2-lipped corolla; four didynamous stamens, and a 2–4-celled ovary, becoming in fruit a drupe or nutlet. The leaves are often covered with transparent glands.

Family Phrymaceae. Lopseed Family. Consists of a single genus and species, *Phryma leptostachya*, a weed-like herb of the eastern United States and eastern Asia. Though formerly included in the Verbenaceae, it is abundantly distinct from other members of that group. Fig. 209 well represents the peculiar reflexed fruit from which the name "lopseed" is derived. The calyx is cylindrical and 2-lipped; corolla 2-lipped, irregular, stamens 4, didynamous; ovary 1-celled, becoming in fruit a dry achene enclosed by the persistent calyx. The plant is common in open woods and and thickets.

FIG. 209. The Lopseed (*Phryma leptostachya*). One-third natural size. Original.

CHAPTER XXXI.—ORDERS PLANTAGINALES AND RUBIALES.

The order Plantaginales comprises only the following:

Family Plantaginaceae. Plantain Family. Contains 3 genera and over 200 species, of almost world-wide distribution. The plantains are herbs of characteristic appearance, the majority stemless, with a tuft of basal leaves, the inflorescence being in a close erect spike or head, very rarely solitary. The calyx is 4-parted and persistent, corolla dry and membranaceous, 4-lobed. Stamens 4. Ovary superior, 1–2-celled, becoming in fruit a small nutlet or a pyxis. The latter is a thin capsule splitting when ripe in a circular line around the middle.

The common rib-grass (*Plantago lanceolata*) is a troublesome pasture weed, as also *P. major* and *P. media*. All three of these are European species. The seeds of *P. major*, the greater plantain, are frequently used in bird seed mixtures. (See Fig. 210.)

The large order Rubiales contains the families Rubiaceae, Caprifoliaceae, Adoxaceae, Valerianaceae and Dipsacaceae. These agree in the following characters: Stamens as many as the corolla lobes and alternate with them, or twice as many. The ovary is compound and inferior, the tube of the calyx being adnate to it. In all the included families the leaves are either opposite or verticillate.

Family Rubiaceae. Madder Family. This very important and

almost entirely tropical group contains about 355 genera and 5500 species of wide distribution. They are herbs, shrubs or trees, with a 4–5-lobed calyx and corolla of varying shape. The ovary is 1–10-celled, becoming in fruit a capsule, berry or drupe. Rubiaceous plants may usually be recognized by the stipules or leaf-like membranes uniting the bases of the opposite or whorled leaves. The family is of great economic importance, containing, as it does, beverage, dye and medicinal plants, not to mention those of ornamental value. In the tribe Cinchoneae, for example, is found the genus *Cinchona*, which consists of evergreen trees growing chiefly in the valleys of the Andes of Peru. Several species yield what is known commercially as Peruvian bark, and it is from this that quinine and the related alkaloids are obtained. These barks have different properties according to the relative proportions of the alkaloid they contain; but in all cases the extract is extremely bitter and possesses prominent tonic qualities.

FIG. 210. The Common Plantain (*Plantago major*). After Britton and Brown, Ill. Fl. Northeast U. S.

The same group contains *Bouvardia*, a genus of handsome green-

FIG. 211. The Partridge-berry (*Mitchella repens*). After Britton and Brown, Ill. Fl. Northeast U. S.

house shrubs, one species of which (*B. triphylla*) is native in our south-

western States. In the tribe Ixoreae is contained the genus *Coffea*, or coffee, one of the important staples of the tropics. The related genus *Ixora* includes some trees with very hard, tough wood, notably the West Indian ironwood (*Ixora ferrea*).

Our native Rubiaceous plants are limited in the northern states to the partridge-berry, *Mitchella* (Fig. 211), the various species of *Houstonia* or bluets (Fig. 212) and the bedstraws (*Galium*), the latter homely insignificant weeds. (Fig. 213).

Family Caprifoliaceae. Honeysuckle Family. Consist of about 10 genera and and 260 species, mostly of the northern hemisphere. They are shrubs, trees, vines, or even herbs, having opposite leaves ordinarily without stipules, and mostly cymose flowers. Calyx 3–5-toothed. Corolla 5-lobed, occasionally bilabiate. Stamens 5 or 4, borne on the tube of the corolla. Ovary inferior, 1–6-celled, becoming in fruit a berry, drupe or capsule.

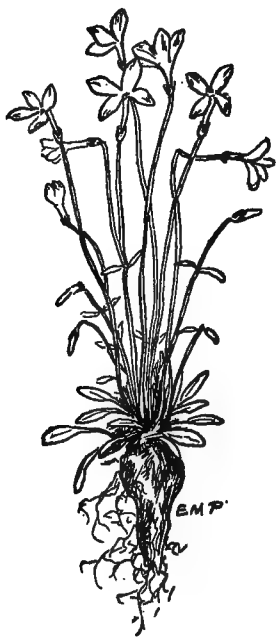


FIG. 212. Bluets (*Houstonia coerulea*). One-half natural size. Original.

The honeysuckles form a very attractive group, most of the genera being ornamental in cultivation. *Lonicera*, which includes all the true honeysuckles, is a genus of shrubby vines, many with evergreen foliage, and all having flowers with great beauty of form and diversity of color; they are also very fragrant. *Viburnum* consists of shrubs and trees, of which the snowball tree is a good example; there are many native species. (Fig. 214.) The dainty little twin-flower of uorthern regions, *Linnaea borealis*, is another number of this family. In the west occur several species of undershrubs with small bell-shaped flowers and white

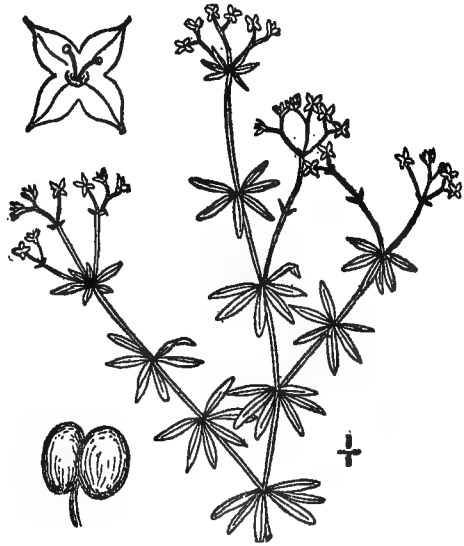


FIG. 213. A native species of Bedstraw (*Galium concinnum*). After Britton and Brown, Ill. Fl. Northeast U. S.

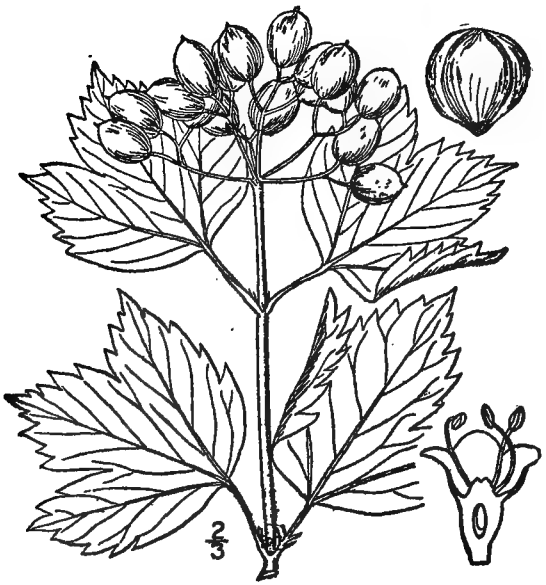


FIG. 214. The Dockmackie (*Viburnum acerifolium*). After Britton and Brown, Ill. Fl. Northeast U. S.

berries. These belong to the genus *Symphoricarpos*. (Fig. 215.) As a general rule, the Caprifoliaceae possess astringent properties. The berries of the elder (*Sambucus*) were often used in early days in making

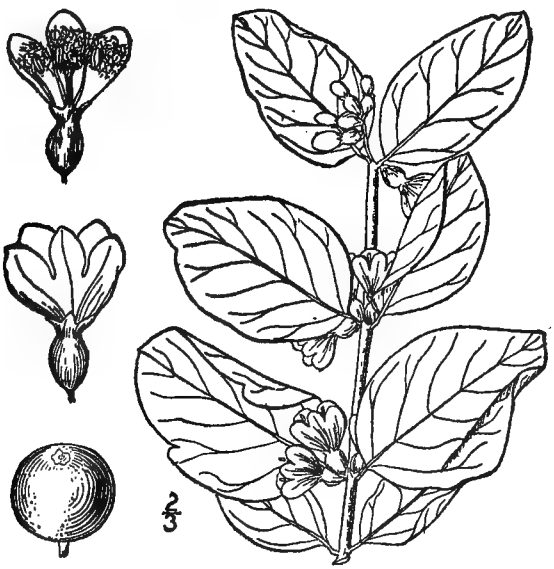


FIG. 215. The Snowberry (*Symphoricarpos racemosus*). After Britton and Brown, Ill. Fl. Northeast U. S.

elderberry wine. In England the Saxons used to hold the elder bush, or "ellhorn," in great awe and reverence. It was supposed to be a sovereign remedy for many diseases, and was also used, like the witch-hazel, as a divining rod.

Family Adoxaceae. Moschatel Family. This consists of a single monotypic genus, the species being *Adoxa Moschatellina*, a slender herb of the northern parts of both hemispheres. It is distinguished from the preceding family by having the stamens twice as many as the corolla lobes, and by its ternately divided leaves.

Family Valerianaceae. Valerian Family. These plants are all herbs, contained in 9 genera and about 275 species of wide distribution. They have opposite leaves without stipules, and small cymose flowers. The distinguishing character of the family is found in the 3-celled ovary, only one cell of which contains an ovule, the others being empty. The fruit is dry and nut-like, one-seeded. *Valeriana*, the valerian, contains the greatest number of species; they are all strong-smelling plants, possessing powerful medicinal properties; none are of much beauty. *Valerianella*, which consists of smallar herbs, is known as corn salad from the fact that several of the species are in cultivation as salad vegetables, particularly in Europe. They possess no distinctive flavor, but are in good condition very early in the season.

Family Dipsacaceae. Teasel Family. Contains about 7 genera and 140 species, natives of the Old World. They are also herbs, with the flowers in close heads subtended by an involucre, like those of the Compositae. The fruit is a small achene, crowned by the persistent calyx. *Dipsacus*, the teasel, has heads of flowers interspersed with rigid spiny points, which in the true fullers' teasel are hooked at the apex; it is thus an invaluable article to the cloth manufacturer, who uses the heads to raise a nap on cloth; no machine has yet been invented that fulfills the same purpose. *Scabiosa*, another large genus of this family, contains a number of species familiar in old gardens under the names of mourning bride and sweet scabious.

The Dipsacaceae and Valerianaceae are held by some authors to constitute a distinct order, the Valerianales.

SUPPLEMENT.

THE FAMILIES OF FLOWERING PLANTS.

By Charles Louis Pollard.

CHAPTER XXXII.—*Order Campanulales.*

THIS order includes the highest types of flowering plants, and consists of the following families: Cucurbitaceae, Campanulaceae, Cichoriaceae, Ambrosiaceae and Compositae. It is distinguished by having the anthers, with very few exceptions, united into a ring. In the two first-named families, the flowers are distinct and separate, but in the last three they are united into a close head, which is subtended by one or more whorls of leaves resembling a calyx, and known technically as an *involucre*. Any of our familiar wayside composites, like the daisy or dandelion, will afford good illustrations of this, the so-called flower consisting of many minute flowerets, each with its own specialized parts.

Family Cucurbitaceae. Gourd Family. These plants are all herbaceous vines, climbing by means of tendrils. The leaves are alternate, and usually palmately lobed or divided. The flowers are monoecious or occasionally dioecious, the male flowers larger and more conspicuous. Calyx adherent to the ovary. Corolla gamopetalous, or sometimes of 5 separate petals. Stamens 3 or 1, irregular. Ovary 1–3-celled, becoming what is known as a pepo, a fruit with a fleshy exocarp and a spongy endocarp filled with numerous seeds, familiar to us in the squash, pumpkin, melon, cucumber and watermelon, all of which are important members of this family. The fruits of many exotic species are highly ornamental, being of odd shapes and frequently of variegated colors. In some few cases, such as "dish-cloth" gourd *(Luffa)*, the fruit is dry and fibrous instead of being fleshy. Fig. 216 shows the habit of a cucurbitaceous vine; it is the balsam-apple, an abundant tropical weed. The family contains about 90 genera and 650 species, mainly natives of warm regions; five genera are represented in the United States.

Family Campanulaceae. Bell-flower Family. These are herbs, shrubs or trees, with an acrid, milky juice and perfect flowers. Calyx adherent to the ovary; corolla gamopetalous, regular or very irregular, 5-lobed. Stamens 5; filaments sometimes united: ovary 2–5-celled or 1-celled, becoming in fruit a capsule or a berry. The family contains about 60 genera and 1500 species, of very wide distribution. *Campanula*, the bell-flower, is distinctive of cold regions, its 250 species being confined to the northern hemisphere. In it the flowers are of the regular type, usually blue or purple, and very showy in some garden varieties. (Fig. 217.) The Venus' looking-glass *(Legouzia perfoliata)* is a common

FIG. 216. The balsam-apple (*Momordica charantia*). One-half natural size. Original.

weed of old fields, and is remarkable for producing, like the violets, cleistogamous flowers, which are fertilized in the bud and never open.

Another division of the family is represented by *Lobelia*, of which there are 225 species. In this group the flowers are irregular, being 2-lipped, with the lips variously cleft. The anthers are united into a tube or ring around the style. There are many tropical allies of *Lobelia*, but the greatest number occur in the Hawaiian islands, and many are endemic there: Our native Lobelias are superior in beauty to those in cultivation; important among these are the cardinal-flower and the great blue lobelia (Fig. 218).

Family Cichoriaceae. Chicory Family. Contains about 65 genera and 1400 species, of wide distribution. They are almost all herbs, with milky juice and alternate or basal leaves. The flowers are borne in heads subtended by an involucre as above described. The flowers are all similar and perfect, the calyx-tube completely adherent to the ovary, the spreading upper portion (known as the *pappus*), consisting of scales or bristles or sometimes wanting. The corolla is gamopetalous, its limb ex-

FIG. 217. A western species of bellflower (*Campanula planiflora*). One-half natural size. Original.

FIG. 218. The great blue lobelia (*Lobelia syphilitica*,) After Britton and Brown, Ill. Fl. Northeast. U. S.

panded into a flat strap-shaped or *ligulate* portion known as a ray; the rays make up the conspicuous portion of the flower, and are what seem to be petals. Anthers united into a tube around the style, the anther sacs appendaged at the base and summit. Style slender and 2-cleft. Ovary 1-celled, with a single ovule, becoming a small seed-like fruit known as an achene. Fig. 219, representing the flower of the dandelion, will serve to make this more clear.

There are many different types of plants among the Cichoriaceae. Some few afford garden vegetables, as the salsify (*Tragopogon*) and the lettuce (*Lactuca*), while the chicory (*Cichorium*) is widely known as an adulterant for coffee. The leaves of the common dandelion are highly esteemed as boiled "greens." Many

FIG. 219. The common dandelion: 1, two flower stalks; in one the head is closed, showing the double involucre, the inner erect, the outer reflexed; in the other the head open, showing that all the flowers are strap-shaped; 2, a single flower showing inferior ovary, pappus, corolla, stamen tube, and two-parted style; 3, a mature achene; 4, a head from which all but one of the achenes have been removed, showing the pitted receptacle and the prominent pappus beak.—After Strasburger. From Coulter's Plant Structure, by courtesy of D. Appleton & Co.

of the plants are troublesome weeds. Thus the genus *Hieracium* or hawkweed, represented in this country by about 30 species, none of which are very troublesome, embraces no fewer than 250 species of the Old World; and of these the king-devil (*H. praealtum*) and the orange hawkweed (*H. aurantiacum*) have become serious pests to the farmers in many parts of New England and New York. In Maryland and the District of Columbia another European immigrant has become troublesome, the gum succory (*Chondrilla juncea*).

The ray flowers of the Chicory family are for the most part yellow, but the chicory itself has blue flowers, and there are other genera with white, pink and red rays.

Family Ambrosiaceae. Ragweed Family. In this group the same floral structure prevails, except that the plants are monoecious or dioecious, and the pistillate head of flowers is frequently larger and nut-like or bur-like in appearance. The corolla is reduced to a mere ring or tube in the pistillate flowers; in the staminate it is tubular and 4–5-lobed; there is no flat or expanded portion corresponding to the rays of the Cichoriaceae. The ovary is inferior. There are 8 genera and about 55 species, largely American. The great bulk of them are pestilential weeds, of which the ragweed (*Ambrosia artemisiaefolia*) may be taken as typical. (Fig. 220.) This plant, with its habit of overrunning every bit of waste land to the exclusion of all other plants, would be sufficiently disagreeable under any circumstances; but when we reflect that it is a disturbing factor, if not a primary cause, of the disease knows as hay fever, it must be accounted a vegetable pariah, to be combated and uprooted wherever it occurs. The cocklebur (*Xanthium*) is also troublesome on account of the propensity of its prickly burs to adhere to everything with which they come in contact (Fig. 221).

FIG. 220. Ragweed (*Ambrosia artemisiaefolia*). After Britton and Brown, Ill. Fl. Northeast. U.S.

Family Compositae. Thistle or Composite Family. This family is the largest in the whole series of flowering plants, of which it comprises about eight or nine per cent. The genera are estimated at 775, the species at 10,000, and the family is distributed over all parts of the world, though as a rule less abundant in tropical than in temperate regions.

The first two tribes in the family consist of the iron-weeds (*Vernonia*), the bonesets (*Eupatorium*) and their relatives. They contain nearly 1,000 species, dispersed throughout temperate and tropical climates. A good example is furnished by the common native boneset (*Eupatorium perfoliatum*), which furnished the thoroughwort tea of our childhood days. (Fig. 222.) The tribe Astereae contains two of our largest

and most familiar North American genera, *Aster* and *Solidago*.

They are the most ornamental of our fall blooming wild flowers, and there is great diversity among the species. (Fig. 223.) Here also belong the various species of *Baccharis*, the only shrubby composite in eastern North America. The Inuleae contain the majority of the so-called "everlastings," the flower-heads of which are dry and chaffy in texture, so that they keep in good condition for a long time. The edelweiss belongs to this tribe, as also the cudweeds and wild everlastings of our meadows The "Rose-of-Jericho" is a species of *Odontospermum* inhabiting the desert of Sahara.

FIG. 221. The cocklebur (*Xanthium Canadense*). After Britton and Brown, Ill. Fl. Northeast. U. S.

The Heliantheae include some of our more showy-flowered composites, such as the sunflowers (*Helianthus*), of which there are many North American species, and the *Rudbeckias*, *Coreopsis* and *Bidens*. The garden marigolds (*Tagetes*) are closely related. (Figs. 224 and 225.) In the Anthemideae belong several of our rank weeds, like the iil-scented mayweed and the ox-eye daisy, also the chrysanthemum, which in its cultivated form has been developed from species with only a single row of rays; the wormwoods and sagebrushes (*Artemisia*) and the feverfew (*Pyrethrum*). A species of the latter genus yields buhach, or Persian insect powder. The Senecioneae contain the huge genus *Senecio* and the garden cinerarias, while the final tribe we shall mention, the Cynareae, comprises all the thistles and thistle-like plants distributed through various genera, of which *Carduus*, *Centaurea* and *Arctium* (the burdock) are the principal ones. (Fig. 226.)

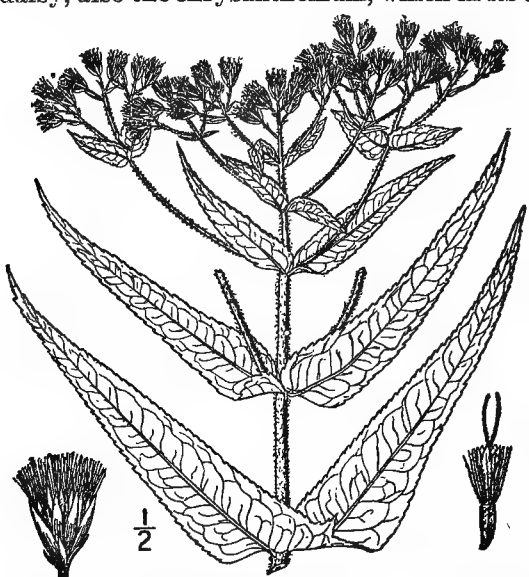


FIG. 222. Boneset (*Eupatorium perfoliatum*). After Britton and Brown, Ill. Fl. Northeast. U. S.

All the Compositae agree in having the same general structure as the Cichori-

aceae: that is, the flowers are aggregated in an involucrate head; but there is this difference, that in the Compositae proper only part of the flowers have strap-shaped corollas, the others being tubular and inconspicuous, like those in the "center" of a so-called daisy flower. In some tribes, indeed, the flowers are all tubular. On an examination of any Composite we can readily understand why this family illustrates the highest development among flowering plants, on the theory that separation of parts is an indication of primitive structure. For here the anthers and filaments are united into a column; the corolla forms a tube; the calyx is in such intimate adherence to the ovary that it may be said to have disappeared; the ovary is one-seeded: the flowers are aggregated in a close head; and the floral bracts are crowded into a calyx-like involucre.

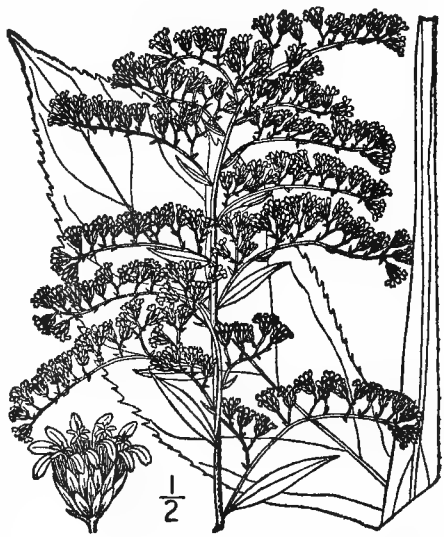


FIG. 223. A native species of golden-rod (*Solidago juncea*). After Britton and Brown, Ill. Fl. Northeast. U. S.

FIG. 224. A western composite allied to the "black-eyed Susan" (*Ratibida columnaris*). After Britton and Brown, Ill. Fl. Northeast. U. S.

And thus, having found our way through the maze of plant fami-

lies, we are ready to recognize the beautiful natural relationships to be found in botany as in other branches of biology. If these somewhat discursive papers have proved serviceable in making the flowering-plant relationships more clear, the author feels that his work has fulfilled its mission.

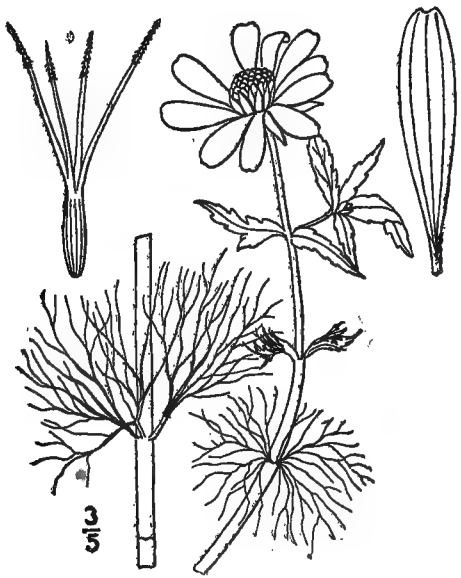


FIG. 225. The water marigold, an aquatic *Bidens* (*B. Beckii*). After Britton and Brown, Ill. Fl. Northeast. U. S.

FIG. 226. Bachelor's-button (*Centaurea Cyanus*). After Britton and Brown, Ill. Fl. Northeast. U. S.

THE END.