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A POPULAR
CALIFORNIA FLORA,

OR,

MANUAL OF BOTANY FOR BEGINNERS,

WITH

ILLUSTRATED INTRODUCTORY LESSONS, ESPECIALLY ADAPTED TO
THE PACIFIC COAST.

TO WHICH IS ADDED AN

ANALYTICAL KEY TO WEST COAST BOTANY.

CONTAINING BRIEF DESCRIPTIONS OF OVER 1600 SPECIES OF
PACIFIC COAST PLANTS.

By VOLNEY RATTAN,

TEACHER OF NATURAL SCIENCES IN THE GIRLS' HIGH SCHOOL,
SAN FRANCISCO.

Eighth Revised Edition.

SAN FRANCISCO:
THE BANCROFT COMPANY,

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PREFACE.

THE first edition of this book was prepared for the press during the evenings and Saturdays of the month of January, 1879. The hope that an abler hand would undertake the task deferred the beginning, and the needs of a class of over five hundred pupils hastened the completion of a work that would have been more slowly elaborated had the reputation of the author been the only consideration. The errors incident to such rapid work were as far as possible corrected the following year, in a second edition, which was pre-faced as follows:

"I have endeavored to prepare an inexpensive manual which will enable beginners in botany to determine the names of all plants with conspicuous flowers that may be found growing wild in the Central Valley of California from Visalia to Marysville, and through the Coast Ranges from Monterey to Ukiah. Over six hundred species of plants are characterized by descriptions condensed, for the most part, from Vol. I of the 'California Botany,' and Sereno Watson's 'Revision of the North American Liliaceæ.' Valuable material has also been obtained from a 'Revision of the Eriogoneæ,' by Torrey & Gray, Gray's 'Synoptical Flora of North America,' and 'Gray's Manual of Botany.'

"Plants belonging to the Parsnip, Aster, Willow, Oak, and Pine Families, are not described, being mostly too difficult for beginners, or of little interest to them. The Introductory Lessons are designed to show the learner how to study the growth of plants, as well as to give such knowledge of their structure as will enable him to understand the descriptions in the Flora. The 'Glossary of Generic and Specific Names' will enable the student to make appropriate common names for most plants.

"To the authors whose works have furnished the materials for this book is due the credit for whatever of excellence it may possess; to the compiler, who may, in a few cases, have misrepresented these authors, attaches the blame for most of its defects.

"I am indebted for suggestions and criticisms to Prof. E. W. Hilgard, Dr. C. L. Anderson, Prof. W. H. Brewer and Dr. Asa Gray. To the latter I am especially grateful for his kind interest in my humble work."

One third of the second edition was new matter, and only about half of the book in its present form is printed from the stereotype plates of the first edition. The newer half of the work, although necessarily partaking somewhat of the nature of patchwork, is as good as I can make it. My drawings upon wood have been faithfully engraved, and, though claiming no artistic merit, will, I trust, prove helpful to the learner. With few exceptions—always noted in the text—the plants, or parts of plants, are represented of the natural size. Besides the more obvious improvements, an entirely new Analytical Key replaces the old one; and our most common oaks are described.

Assuming that facts in natural history are useless if merely memorized from the book, and that the student must earn his knowledge by observing and experimenting, it is obviously best to encourage him at first by showing him how to try simple experiments whose results are easily interpreted. Seeds are the best material for such experiments, since the phenomena connected with their germination are not only easily observed, but deeply interesting. For this reason what may seem a disproportionate space in the Introductory Lessons is devoted to "The Beginnings of Plant Life." There are no lessons of greater educational value than those given to observing eyes by the growth of a plant from the first quickening of the dry embryo to the putting forth of flowers and the ripening of fruit. A sunny window in each school-room should be devoted to these beautiful object lessons of nature. It must not be forgotten, however, that since most young people are eager to learn the names of plants whose flowers they admire, it is best to devote most of the spring months to the study of Systematic Botany. The child's "What is it?" and the finger pointing to the plant in bloom, show plainly with what to begin the study of botany. Baron Frederick von Mueller says in his preface to an elementary work upon the botany of Victoria, Australia: "An experience of nearly forty years has convinced the author that the use of a grammar-like publication for initiating into a study of plants is alike wearisome to teacher and children, and that as a rule, subject to rare exceptions, the knowledge acquired from the ordinary first elementary works on botany is as quickly lost as gained. The only method of rendering such studies agreeable and lastingly fruitful consists in arousing an interest of the young scholars in the native plants of their locality, to afford them all possible facilities to recognize and discriminate all the various plants within reach, to lead them by observations thus started to comprehend the limits of specific forms, of generic and ordinal groups, and to conduct them afterwards to the more difficult study of special anatomy and physiology of plants."

Teachers and learners are here reminded of the importance of carefully writing out the details of experiments tried, as well as descriptions of what has been observed. In the words of Dr. Asa Gray: "The naturalist must not only observe that he may describe, but describe if he would observe."

It will be noticed—and the fact has formed the basis of a criticism—that the descriptions of genera and species in this Flora are very brief; as a rule only the contrasting characteristics being given, since more is calculated to confuse rather than help the beginner. Dr. Gray says: "In floras, as in more general works, abridged descriptions or diagnoses suffice—indeed, are preferable in all cases where the region is pretty well explored, and where materials can be thoroughly elaborated."

Although the Flora is designed especially for students in Central California, it will be found only a little less useful to those studying as far south as Los Angeles, or as far north as the Columbia. The Introductory Lessons are suited to the entire Pacific Coast.

SAN FRANCISCO, January, 1882.

V. R.

INTRODUCTORY LESSONS IN STRUCTURAL BOTANY.

SECTION 1.—THE BEGINNINGS OF PLANT LIFE.

1. If the first rain of the wet season is followed by warm, sunny weather, specks of green will soon appear among the dry stems of last year's weeds; and in fence corners or other eddy nooks where summer winds have drifted seeds and covered them with dust, you may find perfect mats of baby plants. With a shovel skim off a few square inches of this plant-bearing soil, and carefully examine it. Except a few green needles, which you recognize as spears of grass, most of these little plants seem to consist of white stems, which split at the top into pairs of green leaves. Looking sharply, you may find between each pair of leaves a

1. Seed of Bur-clover just before it appears above ground. 2. Same three days older. 3. Mustard. 4. Bur-clover showing the first and second plumule leaves; the former simple (apparently), the latter with three leaflets. 5. Mallows (*Malva borealis*), showing the long-petioled seed leaves (Cotyledons), and one plumule leaf unfolded. 6. Filaria (*Erodium*), with lobed or sub-compound seed leaves.

tiny bud; or, in the older plants, this may have grown other leaves, which curiously enough are not like the first two. (Figures 1 to 6). Searching through the shovelful of earth you will likely find plants in all stages of growth, from swollen and sprouting seeds to stems, which are just pushing their bowed leaf-heads into the sunlight. Here, then, is material from which you may learn how plants grow; a lesson, remember, which no text-book or schoolmaster can teach you. It will be easier, however, since most of these early wild plants come from very small seeds, to take

your first lessons from plants which have larger beginnings. You should first study—

2. **The Plant in the seed.** Get many kinds of large seeds, such as peas, beans, squash-seeds, buckeyes, castor beans, corn, etc. Put them in water that they may become soft enough to be readily separated into their parts. In a day or two starchy seeds, such as peas or beans, will be in good condition.

3. First take a bean and make drawings showing the outlines as seen sidewise and edgewise. Any marks that seem to be found on all beans must be put down in the drawing, but do not bother about the shading. These attempts to represent what you see will lead to the discovery of certain marks on the concave edge of the bean, the meaning of which you may sometime learn by studying the growth of the seed in the pod. After you have thus studied the outside of the seed, slit it along the back with a sharp knife and take out the kernel. It readily splits into halves which are held together near one end by a short stem. Upon breaking them apart the stem sticks to one half, and you discover growing from the inner end a pair of tiny embracing-leaves. Make another drawing and compare it with Fig. 7. Presently it will be clear to you that this entire kernel is a little plant. The plant in this dry apparently lifeless first stage of its existence is called—

4. **The Embryo, or Germ.** This, as you have seen, is made up of the stem, or *Radicle*; the thick parts called *Cotyledons*, and the two-leaved bud, or *Plumule*. The embryo of a pea is similar to that of a bean, but the plumule is more decidedly a bud. Fig. 8 represents the straight embryo of a peanut. The radicle is not bent around against the cotyledons as in the pea and bean, and the plumule shows two divided leaflets. The cotyledons of the squash are thin and the plumule is scarcely visible. Lupine, though its seeds resemble beans, has a long radicle and a minute plumule. The buckeye seems to have a long radicle, but since it splits nearly to its point, where you will find a large plumule, it is evident that the apparent radicle is mostly made up of the cotyledon stems (petioles).

7. One cotyledon of a bean with the radicle and large plumule. 8. Embryo of a peanut. *a*, inner side of one cotyledon with the radicle and plumule; *b*, outer side of the same.

5. **Albuminous Seeds.** Remove the shell-like coat of a castor bean, and carefully split it flatwise. What at first seems to be a large plumule proves to be free from the rest of the kernel, and with care you may be

9. Seed of Willow or Digger Pine cut so as to show the straight embryo in the center of the oily albumen. *a* and *b*, embryo taken out, the cotyledons (*b*) separated. 10. Seed of the Castor-bean. *a*, the broad thin embryo nearly dividing the albumen; *b*, the embryo removed and the leaf-like cotyledons separated. 11. Seed of Datura (*Brugmansia*), showing at *a* the bent embryo in the scanty albumen; *b*, the embryo taken out and the slender cotyledons separated. 12. A grain of coffee. *a*, the straight embryo.

able to get it out whole (Fig. 10.) It is a straight embryo with beautifully veined, leaf-like cotyledons, embedded in a white, oily substance, which makes up the mass of the kernel. This substance is called *Albumen*, a name which applies to anything inclosed with the embryo by the seed coats. Peas, beans, acorns, nuts, and most large seeds have no albumen. Carefully cut thin slices from a well soaked coffee grain until its embryo appears as represented in Fig. 12. The horny, folded albumen makes up most of the seed. A similar, but smaller embryo, may be found in the brain-shaped, fleshy albumen of the ivy seed. The embryo of the Tree-Datura, or Stramonium, is shown in Fig. 11. It has slender cotyledons, folded down against a thick radicle, the whole embedded in tough, fleshy albumen. Take the embryo of a Morning-Glory seed and pick the bits of transparent, jelly-like albumen out of the pockets in the crumpled cotyledons. An attempt to flatten out the cotyledons will probably result in something like *b*, Fig. 13, which may lead you to suppose that the cotyledons are separately crumpled, which is not the case. They stick closely together by their inner faces, as do the cotyledons of other seeds you have examined, and they are crumpled as one; but, being notched at the end, they readily split down the center. Buckwheat seeds will give you some trouble. Indeed, it will

13. Morning - Glory just appearing above the ground with the seed coat sticking to the cotyledons. *a*, the swollen seed; *b*, embryo, with the crumpled cotyledons split down the middle in the attempt to flatten them.

be much easier to make out the exact shapes and positions of the embryos in most albuminous seeds after they have begun to grow.

Monocotyledonous Embryos. Corn, wheat, oats, and possibly a few other seeds in your collection, are different in plan from any yet described. In corn the soft portion called the chit is the embryo. Wheat and oats have smaller but similar embryos. You cannot easily distinguish the parts of these embryos, but you can, at least, determine that they have *not two* cotyledons. Really they have *one* cotyledon, and are therefore said to be *Monocotyledonous*. When you study the growing seeds you will see how widely they differ from seeds which have—

Dicotyledonous Embryos. These are embryos, which, like the bean, have two cotyledons. A few plants belonging to the *Pine Family* have

Polycotyledonous Embryos. Fig. 12 shows the embryo of the common Willow or Digger Pine, which has more than two cotyledons in a whorl at the top of the radicle.

The Germination of Seeds. Plant the remainder of your seeds—those of a kind together—in boxes or pots of sand, or any kind of loose soil you can get. Keep this little experimental garden in a warm place, where it can get a bit of sunshine, and water it daily. At intervals of three or four days dig up one of each kind of seed, and, after careful examination, make drawings to illustrate the successive stages of growth. It is of the greatest importance that you repeatedly attempt to draw what you see; it is of the least importance that your drawings are pretty.

You will learn, among many interesting facts, that most seeds are pushed up to the surface of the ground by the growth of the radicle. There the seed-coats drop off (except that in seeds without albumen the cotyledons are apt to slip out of their coats on the way up); the cotyledons spread apart, become longer and broader, and turn green; lastly, the plumule becomes a leafy stem. Meanwhile, roots grow from the lower end of the radicle. Some cotyledons, like those of the pea, do not appear above ground, but send the plumule up. The seeds of Big-root—a pest which grows in nearly every field—behave in a remarkable manner. The nut-like seeds drop from their prickly pods in June or July, and soon become covered with leaves. The rains of November and December cause them to sprout, as represented at *d*. The mimic radicle—really a

tube formed by the united petioles, or stems, of the thick cotyledons, and only tipped by the radicle—penetrates the ground to a depth, usually, of four or five inches. The plumule meanwhile, as shown in *f*, remains dormant in the bottom of the tubular sprout. When the petiole growth ceases, the radicle grows rapidly by absorbing the nourishment stored in the cotyledons, and becomes a tuber. Meanwhile the plumule begins its upward growth, splitting the petioles apart, and usually escaping from between them, as shown in the figure below *c*. In this wonderful way the plumule bud is deeply planted together with nourishment (stored in the radicle) which, if necessary, can be used to aid its

first growth. The reason for this curious behavior is obvious, when we know that ground squirrels are fond of these seeds, and that a severe frost will kill the young plant. If the seeds wait till warm weather to sprout, hungry rodents may find them; if they germinate early, and in the manner of other seeds, Jack Frost may nip them.*

* Dr. Asa Gray, who first experimented with these seeds, found them to grow as represented at *a*, in the figure [reduced one fourth from Fig. 43, Botanical Text-book, edition of 1879]. Evidently on account of some obstruction, probably the bottom of a small pot, the seeds were elevated two or three inches above the surface of the soil [the dotted line *S* represents the surface of the ground for figures *a*, *b*, and *c*]. My experiments with seeds planted in shallow boxes gave very different results—shown at *b*, which is a reduced copy of Fig. 14 of second edition. The plants came up about four inches from where the seeds were planted, the plumule being pushed laterally that distance by the elongation of the cotyledon petioles. Such inexplicable behavior stimulated to further observation, which resulted in the discovery that naturally planted seeds, unhampered by boxes or pots, usually grow as represented at *c* and *d*. In one instance a sprout measured seven inches from the plumule to the cotyledons! The hairs at *e* probably help the sprout to penetrate the soil, by fastening on to the surface crust. Curiously enough, growing sprouts underground frequently avoid obstacles without touching them.

a. *Lupinus micranthus*; the first plumule leaf on the left. *b.* *Lupinus arboreus*, as it appears when grown in sand; the root-hairs are laden with sand. *c.* *Lupinus densiflorus*. *d.* The same, after the cotyledons are fully developed, and the plumule has appeared.

Lupines ordinarily grow as represented in the cut at *a*, but a common white-flowered kind presents at the end of a month's growth the queer appearance shown at *d*. At first the sprouting seeds appear to be like those of other lupines (see Fig. *c*), but when the cotyledons open, they are seen to be united by their broad bases. For two or three weeks the cotyledons enlarge; not only becoming broader, but thicker; yet we look in vain for a trace of the plumule. Meanwhile a white pustule has been growing, which finally bursts and discloses the partly grown leaves of the missing bud, which has all this time been hidden in the thick stem below the cotyledons! Now, the tough leathery skin of these cotyledons is proof against the nightly frosts that prevail at this season of the year (December), so they go on preparing food from the air with which to feed the tender plumule, until it also is strong enough to face Jack Frost. If you carefully examine these seeds in various stages of their growth, you will learn that the plumule is at the bottom of a short tube formed by the united petioles of the cotyledons. Sometimes the plumule breaks out through

the side of this tube below the cotyledons, instead of bursting through between them.

Do not fail to see for yourself how squash embryos pry open their tough coats. Soon after the sprout has gained a foothold in the soil, a little knob grows on the side of the radicle so as to split more widely open the point of the seed coat, as shown in Fig. *c*. Then the radicle stem between the knob and the cotyledons, by growing, pries the seed still wider open, as seen at *b* below. Finally, by continued growth, the cotyledons are pulled out of the seed coat and upward to the surface of the ground, where they expand, and become pretty good leaves. Seeds planted edgewise, which of course could rarely happen in nature, can not thus free themselves of their seed coats, and it has been proved by a French botanist (M. Flahault) that seeds which come up with their coats on do not thrive. The seed at *b* in the figure was first planted the other side up. It was turned over when the knob on the right had begun to open the seed. The radicle, which then pointed directly upward, gradually straightened, bent downward, and finally the second knob grew, by the help of which the seed leaves were in a fair way to get out when the drawing was made. Some native California plants get out of their coats in a similar manner.

Germination of Albuminous Seeds.

You have observed that when seeds without albumen send their cotyledons above ground, the seed coats are usually left behind, but the albuminous seeds named in paragraph 5 retain their seed coats often for several days after they come up. Examine the coats after they are thrown off, and you will find none of the albumen which formed the larger part of their contents before germination. The enlarged cotyledons tell what has become of it, and it is now plain why the coats were retained.

a. Section of a seed of *Peonia Brownii*, showing the small embryo at the right in the copious albumen. *b.* The embryo removed and the cotyledons separated. *c.* The germinating seed. *d.* The same, with the seed coats removed to show the leaf-like cotyledons. *e.* Plumule bud, or real end of the upward-growing stem. *f.* The first plumule leaf as it appears above ground, the terminal bud yet dormant under ground. *g.* Seed of *Pinus Sabiniana* (Digger, Willow, or Nut Pine) soon after it appears above ground. *h.* Same, with the seed coats removed to show the 14 cotyledons. See Fig. 2, p. vii.

You must have wondered why the cotyledons of a bean, which never become leaf-like, should appear above ground. It is equally strange that the albuminous seeds of the peony should behave in the reverse way. As shown in the cut (*a* and *b*), the embryo is very small. In germination the plumule comes up while the cotyledons become decidedly leaf-like, and fill the shell which has been emptied of its albumen to feed them and the plumule. These thin, veiny seed leaves could certainly do better work above ground than those of most lupines, yet they never come up. There is another curious thing about the growth of peony seeds, which you may try to discover.

When the buckwheat and cotton seeds have begun to sprout, you can study their embryos. Note how the thin, broad cotyledons of the former are folded once and rolled up with a layer of snow-white starch; and how the speckled seed leaves of the latter are folded along the center, then outwardly back, and finally crumpled endwise to make them fit coats too short for them. Maple seeds have curiously crumpled and folded cotyledons. Indeed, all seeds have interesting lessons to teach us.

Germination of Monocotyledonous Seeds. The seeds named

in paragraph 6 do not clearly show their embryos in germination, but they are readily enough distinguished from dicotyledons. The downward growing sprouts are several instead of one, and the upward growing sprout is like a rolled grass leaf (Figs. 15 to 17). By tasting of the growing seeds you can discover what the starchy albumen is changed to before it is fit food for the young plant. It must be remembered that only the grass-like monocotyledons grow as here represented. If possible, get Lily seeds, Iris seeds, etc.

If you examine seeds and study their growth as you have been directed, you will have the evidence of your own eyes that an embryo is a plant in a sort of sleeping state from which it may be aroused to activity by moisture and warmth. It will be evident that the radicle is a stem; that the cotyledons correspond to leaves, and that the plumule is a bud from which is to grow all the above-ground portion of the plant. Remember, that if these, or any other statements concerning the structure and behavior of plants, are not confirmed by your own judgment upon what you have yourself observed, they are useless to you, except as guides pointing to what you are to find. To memorize these statements of facts is to secure the husks, not the kernels, of knowledge. Plants themselves must teach you how they grow. The book can only show you how to question them and how to interpret their answers. Do not fail to carefully compare the results of all your experiments; for in this way you can decide what are general or usual facts, and what are exceptional. The latter should be closely investigated, since it is probable that there is a reason for all unusual as well as usual behavior of plants.

15. Germinating corn. 16. Wheat. 17. Wild-oats; *a*, colorless sheath inclosing the first plumule-leaf *b*; *c*, the twisted and bent beard by means of which it is able to travel to cracks in the ground and thus plant itself.

SECTION 2.—THE STRUCTURE OF PLANTS.

Stems. While awaiting the development of germs in your experimental garden, you can study plants which have already reached maturity in wild gardens. Go out and dig up the first plant—not too large—that you find in blossom. I will suppose that you have found the very common *Filaria* (also called Pin-clover; and children call the curious seeds with twisted tails, clocks). Its parts are *Roots*, *Stem*, *Leaves*, and *Flowers*. (Some time, if you continue studying Botany, it will be proved to you that flowers are forms of stems, or stem-branches.)

Crush the stem. It is made up of stringy fibers and a soft substance filled with juice. The former is generally called *Fibrous Tissue* or *Wood*; the latter, *Cellular Tissue*. The lower part of the stem and the upper part of the root—the older portions of the plant—contain more wood than the branches and the rootlets, while the leaves have only net-like skeletons of wood. It would be interesting to study these tissues with the aid of a microscope, and thus become acquainted with the innermost structure of plants; but for the present it will be sufficient if you can distinguish, in a general way, wood from cellular tissue.

Cut the stem squarely across near the upper end, and from one piece take a thin slice. Stick this on a pin and hold it up to the light. It is nearly transparent, except a green ring of skin outside and a ring of white dots inside. The latter are cut ends of woody fibers which run lengthwise of the stem. Make a similar section of the lower part of the stem and you will find a continuous ring in place of the dots, showing that in the older part the fibers have become so numerous as to form a hollow cylinder of wood. The inclosed cellular tissue is called the *Pith*.

Exogens and Endogens. If the stem lives year after year there will be added successive layers of wood outside of the first one. Such stems are woody, and if they grow many years become *Bushes*, *Shrubs*, or *Trees*. Plants that grow in this way are called *Exogens*. Examine Asparagus, Soap-root, Iris, or any Lily and you will find the wood fibers scattered irregularly through the stems. These plants are *Endogens*. All our native

trees and most other plants are exogens. Palm-trees, Century-plants, grasses, and the "small grains," are endogens.

Herbs are plants whose stems die, at least to the ground, after they have blossomed and matured fruit. These are *Annuals* when their lives are limited to one season; *Biennials* when they die the second year—not producing fruit the first year; *Perennials* when they live on year after year, their stems dying annually down to the ground. The underground portions of such stems are called—

Rootstocks. This name applies more particularly to such stems as grow nearly horizontally under ground, or become thick and fleshy with nutritious matter, which enables the plant to make rapid first growths each year. A rootstock can usually be distinguished from a true root by its bearing buds.

Bulbs are formed by a peculiar bud growth in which the leaves or their bases become very thick and fleshy, with a store of nourishment, while the stem grows in diameter, but scarcely at all in length.

Coated or Tunicated Bulbs are those in which the leaves form a succession of envelopes, as in the onion. If the leaves or leaf-bases are narrow, as in the lily, the bulb is *Scaly*.

Corms resemble bulbs, but are solid, and have more the nature of *Tubers*, which are the thickened ends of slender, branching, underground stems, as potatoes, ground artichokes, etc.

Leaves. Collect the leafy stems of many kinds of plants. Observe the arrangement of the leaves on the stems. A few like *Erodium* (*Filaria*), the *Catchfly*, *Pink*, *Fuchsia*, *Mint*, etc., have *Opposite* leaves. Possibly you may find a *Collinsia*, or stem of *Cleavers*, with the leaves in *Whorls* of three or more. Most plants have *Alternate* leaves. You will find some plants like *Plantain*, with a bunch of leaves growing from the ground, but no leafy stems. Such leaves come from rootstocks, and are said to be *Radical*. *Plantain*, *Dodecatheon*, *Primrose*, etc. have the leaves all radical. Many perennial herbs have radical leaves, as well as ordinary stem leaves, and these usually differ more or less from the stem leaves.

Observe that stems and branches end in buds or flowers, and that

there is usually a bud, or branch, or a flower at the base of a leaf between it and the stem from which it grows.

Buds and flowers at the ends of stems or branches, are *Terminal*; when between the stems and leaves, *Axillary*.

Examine the leaf of a Violet or Pansy. You can readily distinguish three parts: A broad *Blade*; a stem or *Petiole*, and a pair of appendages at the base of the petiole called *Stipules*. The latter in the Pansy are leaf-like. Sometimes they are mere scales, and frequently there are none at all. The petiole may be wanting, also; the leaf is then said to be *Sessile*. Leaves with but one blade are—

Simple Leaves. The illustrations (Figures 18 to 32) show the principal forms of simple leaves or leaflets of compound leaves. Carefully compare the blades of your leaves with these shapes. If the leaf in hand does not correspond with any of the figures, you may describe it by combining the descriptive words, or by adding a word. A leaf, for example, too broad to be lanceolate, and narrower than ovate, if about half way between the two forms, is *Ovate-lanceolate* or *Lance-ovate*; the first, if nearer ovate; the latter, if nearer lanceolate. Or, if merely a little broader than lanceolate, we may say it is *Broadly-lanceolate*; when more slender, *Narrowly-lanceolate*; if slender and nearly as broad in the middle as nearer the base, it is *Linear-lanceolate*, etc. So, too, there are interme-

FORMS OF LEAVES.—18. Linear. 19. Oblong. 20. Elliptical. 21. Orbicular. 22. Peltate (Shield-shaped). 23. Hastate (Spear-shaped). 24. Sagittate (Arrow-shaped).

diate forms described by such terms as: *Oblong-lanceolate*; *Narrowly-elliptical*; *Broadly-elliptical*—which approaches orbicular; *Broadly-cordate*—

which becomes reniform if the apex, is rounded, etc. *Obovate* ; *Oblanceolate* ; *Obcordate*, etc., apply to forms the reverse of ovate, lanceolate, etc.

FORMS OF LEAVES.—25. Lanceolate. 26. Oblanceolate. 27. Spatulate. 28. Ovate (Egg-shaped). 29. Cordate (Heart-shaped). 30. Reniform (Kidney-shaped). 31. Falcate (Sickle-shaped). 32. Hastate (Spear-shaped). 33a. Auriculate (Eared) base.

Apexes of Leaves. There are terms descriptive of the apexes (the upper ends) of leaves. Fig. 18 has a *Cuspidate* apex; Fig. 19, *Notched* or *Emarginate* ; Figures 23, 24, 29, *Acute* ; Fig. 25, *Acuminate* ; Fig. 26, *Obluse*.

Margins of Leaves. All these forms are represented as having

LEAF MARGINS.—33. Serrate. 34. Dentate. 35. Crenate. 36. Wavy. 37. Sinuate. 38. Incised. 39. Erose.

entire or nearly entire margins, but the margins may be notched or cut in various ways. Figures 33 to 39 will assist you in describing the margins of your leaves. Here, also, you will find it necessary to combine ad-

jectives or use adverbs. Leaves may be *Finely-serrate* or *Coarsely-serrate*; and *Dentate*, *Crenate*, etc., may be similarly modified.

40. Pinnately lobed leaf, of White Oak (*Quercus lobata*). 41. Pinnately parted leaf of *Nemophila aurita* (Lobes retrorse). 42. Pinnate leaf of *Erodium moschatum*. 43. Palmately lobed leaf of Maple. 44. Palmately parted leaf of *Viola lobata*.

Lobed Leaves. These may be *Pinnately* or *Palmately* lobed, depending upon whether there is more than one rib proceeding from the

base of the leaf. Fig. 40 represents a pinnately lobed leaf; Fig. 43, palmately lobed. When leaves are deeply lobed, as in Figures 41 and 44, they are said to be *Parted*. *Divided* leaves are cut quite to the midrib if pinnately divided, or to the end of the petiole when palmately divided. *Cleft* leaves have the sinuses between the lobes sharp as in Fig. 38. When leaves are pinnately cleft about half way to the midrib they are said to be *Pinnatifid*. If the lobes are pinnatifid it is described as *Bipinnatifid*. It is common to give the number of lobes in the descriptive phrase, as pinnately nine-lobed (Fig. 40); pinnately eleven-parted (Fig. 41); palmately five-lobed (Fig. 43); palmately five-parted (Fig. 44).

Compound Leaves have distinctly separate leaflets usually jointed to a common petiole, just as simple leaves are jointed to the stem. A leaf is *Pinnate*, when the leaflets grow along opposite sides of the petiole (Fig. 42); *Palmate*, if they all grow from the end of the petiole (Fig. 46). Fig. 45 represents a *pinnately 3-foliolate* leaf; Fig. 46, *palmately 3-foliolate*. When there is no odd leaflet at the end the leaf is *abruptly* pinnate. Leaves may be *twice, thrice*, etc., compound, that is, the leaflets may be compound as in some acacias.

Bracts are leaves among flowers, or small undeveloped leaves anywhere on the stem.

Stipules may be *adnate* to the base of the petiole, as in the rose and clover (Figures 45, 46); they may grow on the stem; or, as in some plants of the Buckwheat Family the stipules form a sheath surrounding the stem at the base of the petiole. Do not mistake the first leaves of a growing axillary bud for stipules.

Venation of Leaves. All the leaves thus far described are said to be *Netted-reined* or *Reticulated*, because their skeletons of wood fiber

45. Pinnately 3-foliolate leaf of Bur-clover, with small stipules. 46. Palmately or digitately 3-foliolate leaf of a true clover, the broad adnate stipules lacerate.

resemble nets. Examine the leaves of Iris, Calla, or any that are grass-like, and you will see why they are called *Parallel-veined*.

Netted-veined leaves grow on *Exogenous* stems. *Parallel-veined* leaves grow on *Endogenous* stems. The former belong to plants which grow from *Dicotyledonous* seeds; the latter to plants from *Monocotyledonous* seeds.

Flowers. Get a bunch of Mustard flowers—Wall-flowers, single Stock, or Radish flowers will do as well. Pluck a single blossom and note these facts: The most conspicuous part consists of four yellow leaves; outside of these are four smaller greenish yellow leaves in pairs not quite alike. The latter are *Sepals*, and together form the *Calyx*; the former are *Petals*, and together form the *Corolla*. Pull off the sepals, observing that they alternate with the petals. Next remove the petals. The broad part of each petal is called the *blade*, the narrow part, the *claw* (corresponding to the petiole of an ordinary leaf). Inside of the petals you find six yellow-headed bodies with white stems, two of which are shorter than the remaining four. These are the *Stamens*. Their stems are *Filaments*; the yellow heads are *Anthers*, and the yellow powder which they contain is *Pollen*. In the center of the flower is a club-shaped body called the *Pistil*. This is the young seed-pod, and by splitting it open you may see the minute *Ovules*, which are the beginnings of seed. The part containing the ovules is the *Ovary*; the naked upper end of the pistil is the *Stigma*, and the part connecting the stigma with the ovary is the *Style*. The end of the stem upon which the parts of the flower grow is the *Receptacle*, and the stem is called a *Peduncle*. Fig. 47 will assist you in learning these names.

A *Complete Flower* must have calyx, corolla, stamens and pistils; but, since the office of a flower is to produce seeds, and these grow from ovules, which pollen has reached by way of the stigma, it follows that

47. Magnified Mustard flower with four of the stamens, three petals and three sepals removed.

A *Perfect Flower* may consist of pistils and stamens only, and of these the styles and filaments are not essential.

Cohesion of Floral Organs. When sepals cohere or grow fast to each other (Figs. 48-51) the calyx is *Gamosepalous*. So, also, the corolla may be *Gamopetalous*. When stamens cohere they are *Monadelphous* if in one set, *Diadelphous* if in two sets (usually 9 and 1), etc. Cohering pistils (carpels) form a *Compound Pistil*. The degrees of cohesion in calyx and corolla is described, as in leaves, by the terms *entire*, *cleft* or *lobed* and *parted*. Thus: Bindweed (Fig. 50) has an entire corolla limb; *Zauschneria* (Fig. 51) has a 4-lobed calyx; *Nemophila* has a 5-parted or deeply 5-lobed corolla, etc. If the flower has a limb (border) distinct from the tube, these terms apply to the limb.

Adhesion of Floral Organs. The calyx may grow fast to the ovary (Fig. 51), then it is said to be *Superior* (ovary *inferior*). The corolla and stamens frequently grow on the calyx, as in *Fuchsia*, *Strawberry*, etc.; then they are said

48. Bud of *Eschscholtzia*, with the mitriform calyx removed and shown above. 49. Open flower of the same, with two of the petals removed, one of these below with the stamens adhering to the claw. 50. Flower and leaf of *Convolvulus arvensis*; above is the corolla split down, displaying five unequal stamens.

to be *Perigynous*; or the stamens may grow on the corolla (Fig. 50) as in most gamopetalous flowers, and in *Eschscholtzia* (Fig. 49). In the Orchis Family the stamens grow on the pistil.

Irregular Flowers are those in which parts of the same kind are unlike in form or size.

Inflorescence. The forms of flower-clusters are almost as various as the shapes of the flowers, but they may all be referred to two plans, viz.: *Terminal* and *Axillary*. The *Raceme* (Fig. 52) is a simple form of axillary inflorescence in which the leaves are reduced to bracts. If the flowers are sessile (without pedicels) the raceme becomes a *Spike* (Fig. 53). If the older flowers are raised on long pedicels the flat-topped cluster is called a *Corymb* (Fig. 55). In an *Umbel* the pedicels all grow from the end of the

54. Cyme. 53. Spike. 52. Raceme.

56. Umbel. 55. Corymb.

peduncle (Fig. 56). If these are very short or obsolete a *Head* is formed. A *Panicle* is a loose compound raceme. A *Thyrse* is a dense panicle. Fig. 54 represents a *Cyme*, the type of terminal inflorescence. A many-flowered cyme is a *Fascicle*; more densely flowered, a *Glomerule*. *Cymes* and *Fascicles* resemble *Corymbs*; but in the former, the central flowers are

the older, while in the latter, the younger flowers or buds occupy the center. *Glomerules* differ from heads in the same way.

The woodland flowers *Trillium* and *Anemone* furnish examples of the simplest form of *Terminal Inflorescence*. Their simple stems bear each one flower at the top. Often flowers seem to be axillary when the plan of inflorescence is terminal. Fig. 57 illustrates a case of this kind.

Suppose that one of the branches in Fig. 54 had failed to grow. The first flower would then appear to be axillary. In the plant represented by Fig. 57, two of each set of three axillary buds usually remain dormant. Their growth would complete a *Trichotomous Cyme*. Fig. 54 represents a *Dichotomous Cyme*. Imagine the plant shown in Fig. 57 to continue branching, the stem to be shortened so as to bring the flowers close together, and the leaves to become obsolete. A bunch of flowers, having the appearance of a one-sided raceme, would be formed. Let the flowers become sessile, and we would have a false spike. Such mimic racemes and spikes are usually coiled as shown in Fig. 64.

The common *Anagallis*, whose pretty salmon-colored flowers appear in the axils of the opposite leaves (Fig. 58), is an illustration of simple *Axillary Inflorescence*. Imagine the leaves reduced to bracts, and the stem shortened. The fruit, flowers, and buds would then form a *Bracteate Raceme*. Let the bracts become wanting, and we would have a naked or *Bractless Raceme*, similar to the one shown in Fig. 59. This raceme wants only a slight lengthening of the lower pedicels to become a *Corymb*. Indeed, it might be called a *Corymbose Raceme*. Fig. 60 represents a naked raceme, in which only one or two flowers are in

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bloom at a time. A dense *Spike*, bearing a ring of flowers between growing ovaries below and expanding buds above, is

shown in Fig. 61. The coiled spike (Fig. 64) is really a kind of cyme, as has been shown. This *Scorpioid Inflorescence* is characteristic of two

families of plants, represented by many plants on this coast. Mosquito Bills (Fig. 62) grow in *Bracteate Umbels*. The *Head* or *Capitate* cluster (Fig. 63) is like an umbel, only the pedicels are mostly very short. When the flowers are numerous, the head becomes *Globose*. The true clovers have *capitate* flowers. When the pedicels in a raceme branch so as to bear two or more flowers each, a *Compound Raceme* is formed. So in like manner *Compound Umbels*, *Spikes*, and *Corymbs* may be formed. These

flower bunches, cymes, racemes, etc., may be at the ends of main stems or branches, or in the axils of leaves, or replace single flowers in any kind of inflorescence.

The Calyx, as we have already learned, is composed of leaves called *Sepals*, which, though different from ordinary leaves in shape, are usually green. When the sepals are separate, the flower is *Polysepalous*. Sepals united partly or wholly form a *Gamosepalous* calyx. If the sepals drop off when the flower opens, as shown on p. 20a, they are *Caducous*. If they fall with the petals, or before the fruit is ripe, they are *Deciduous*. A *Persistent Calyx* remains until the

fruit ripens (Fig. 65). A colored calyx—i. e., not green—is said to be *Petaloid*. Flowers without petals and those of the Lily Family usually have petaloid sepals (Figs. 66, 70, 71).

The **Corolla** is *Polypetalous* when the petals are free from each other (see Figs. 66, 68, 69, 73). In *Gamopetalous* corollas there are all degrees of cohesion from the complete union (Fig. 67) of the *Entire* limb to the almost free petals of a *Divided* corolla (Fig. 58). Petals often grow upon the calyx (Fig. 68). Corollas are *Regular* (Figs. 67, 69) or *Irregular* (Fig. 66, and Fig. 58, p. 3. See also the figures on p. 11 and p. 88b). Common forms of regular corollas are *Rotate* (Fig. 58), *Salverform* (Fig. 64), *Funnel-form*

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(Fig. 67), and *Campanulate* or *Bell-shaped* when the tube expands suddenly at the base to a width nearly equal to that of the summit and about equal

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73. A flower of *Whipplea*, magnified, cut down through the center, showing the partly inferior ovary and the introse anthers.

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to a third of the length. Irregular flowers are frequently *Bilabiate* or *Two-lipped*, as shown in the figures *a* and *c* on p. 11, and the figures on p. 88b. When the tube of a corolla is slender, and the regular or irregular limb is small or wanting, the flower is said to be *Tubular*. The term *Perianth* is used to designate the calyx and corolla taken together. It is mostly used in describing endogenous flowers (Figs. 70, 71).

Stamens may grow upon the receptacle (Hypogynous, Fig. 69), upon the calyx (Perigynous, Fig. 68), upon the corolla (Fig. 67), or upon the pistil. Stamens are often united by their filaments so as to form tubes (Fig. 74) or bundles; or the anthers are joined, as in the Sunflower or

Thistle. Sometimes there are two kinds of stamens in the same flower (Fig. 68). *Staminodia* are antherless or abortive stamens (see longer stamens in Fig. *e*, p. 8). *Anthers* usually consist of two cells, which are filled with *Pollen*. If the upper end of the filament lies exactly between the anther cells, the anther is *Innate*. An *Adnate* anther is attached by one side to the filament (Figs. 67, 68). A *Versatile* anther is attached between its ends by one side to the tip of the filament (Figs. 71, 72). The pollen usually escapes from slits in one side of the anther, as shown in Fig. 69. This side, which in an adnate or versatile anther, is opposite the filament, is called the face of the anther. When the anther faces

the pistil, it is *Introrse* (Figs. 68, 71, 72, 73); and when it faces away from the pistil, it is *Extrorse* (Fig. 69).

The Pistil grows upon the receptacle, or upon a stem arising from it, called a *Stipe* (Fig. 71). In a few orders there are several or many pistils in each flower. Usually there is but one, formed of several simple pistils (carpels) united more or less closely. As in the other floral organs, there are all degrees of cohesion, from a slight union of the bases of the ovaries—rarely of the stigmas only—to such completeness as leaves no trace of lobes in the stigma (see Fig. on p. 5). Often the free styles tell how many carpels compose the pistil (Fig. 69). Generally the stigmas are divided or lobed (Fig. 68). These marks wanting a cross section of the ovary, or, better still, of the partly grown fruit, will usually show a cell for each carpel (see the right-hand figure, p. 88b). If the ovules (or young seeds) are in the center or grow on more than one side of the ovary (or pod), the pistil is compound. A simple pistil is generally plainly one-sided. A symmetrical pistil is compound.

Inferior Ovaries. When the calyx adheres to the ovary, so as to form, after the ovary has matured, the outer part of the fruit, it is said to be superior, because the apparent calyx, its lobes, or cup, seem to grow upon the ovary. For the same reason the ovary is said to be inferior (Figs. 68, 72). There are all degrees of adhesion, from the slight union at the base, as seen in *Whipplea* (Fig. 73), to the remarkable extreme exhibited in the plant figured on p. 5, in which not only the ovary, but several inches of the style, is adherent to the calyx. When the adhesion is only partial, it can be shown by cutting the flower vertically, as represented in Fig. 73.

The Fruit is the ripened ovary (or set of ovaries), and all that directly belongs to it. A dry fruit which opens in any way to let out the seeds is called a *Pod*. A pod formed by the growth of a simple pistil (one-carpeled) is called a *Follicle* when it splits only along the side which bears the seeds. A *Legume* splits down both edges. Pods formed of several carpels are called *Capsules*. *Akenes* are dry, indehiscent, seed-like fruits, containing but one seed. *Utricles* are distinguished from akenes by their thin coats, which are too large for the inclosed seed.

There are many other names applied to fruits, which it is not necessary to define here.

The Growth of Ovules. You can not study the development of ovules from the beginning, without the help of a compound microscope, but you can easily observe all stages of growth, from a tiny green speck to the full-grown embryo. Most seeds are nearly full grown in appearance before the embryo is more than fairly visible to the naked eye. The seed coat, filled with a syrupy or milky, usually sweet, liquid, appears to constitute the very young seed. With a sharp knife cut in halves a great many green peas, in size from half grown upward. You will surely find in some of

them tiny green embryos, and you may get specimens from the size of a pin's head up to those which tightly fill the seed coat. In Fig. 75, at the top, is seen—magnified two diameters—the young seed of a lupine, cut so as to show the young embryo lying in one end. In the same figure is represented a radish pod, laid open so as to show three of the seeds, two of which exhibit their partly grown embryos.* Below, at *b*, is one of these magnified, and at *a* an older one, also magnified. The grown embryo completely fills the seed. Observe the positions of the embryos in relation to the stems of the seeds and the stems of the pods. The lower seed in the radish is fastened to the lower side of the pod, the middle seed grows to the upper side. The cotyledons increase much more in size than the radicle. The embryo evidently grows, in part at least, by absorbing the liquid around it. Suppose the embryo of the lupine to quit growing at the size represented in the figure, and that the liquid around it thickens until it becomes solid. Would not the seed thus formed be albuminous?

*These are cut in two. The embryo may be seen through the seed-coat, as represented at *b*, by holding it up to the light. Half of the seed-coat is removed from *a*.

SYSTEMATIC BOTANY.

NAMES OF PLANTS: CLASSIFICATION.

In a general way we designate the objects around us by single names. We speak of a stone, a wolf, or a pine; but to distinguish the kinds we naturally use two names, as lime stone, sand stone; grey wolf, prairie wolf; nut pine, yellow pine, etc. This is one step in classification, and the only one commonly taken. This natural plan of double names was adopted by the great naturalist, Linnæus, who gave names to most European plants, as well as to many of this continent. He wisely gave the Latin form to his names, since that language (being the base of most languages spoken in civilized countries) is the natural source of cosmopolitan names—those truly common to all people. Botanical names, then, differ from so-called common names principally in form, and they have these decided advantages: they more exactly represent the relations between kinds of plants, and they are names that are common to people of all languages. In short, they are the true *common names*.

It is not true that botanical names are harder than local names. The most common of our ornamental plants are well known by their scientific names. No one thinks of calling the following botanical names hard: Geranium; Aster; Verbena; Petunia; Portulaca; Crocus; Phlox; Fuchsia; Iris; Magnolia; Oxalis; Azalea; Dahlia; Lobelia; Arnica, etc. Most people talk familiarly of Camellias, Callas, Begonias, Acacias; etc.: while our beautiful California plants, Clarkia, Collinsia, Eschscholtzia, Nemophila, etc., are well known by their proper names—at least, in other countries.

Generic Names correspond to the second parts of the compound common names, as oak, pine, rose, etc. Some of these are the old Greek or Latin names of the plant. Most generic names are either derived from Greek or Latin words descriptive of some peculiarity of the plant, or they are commemorative of some botanist, as Thysanocarpus, from Greek words meaning fringe and pod; Kelloggia, in honor of Dr. A. Kellogg, a veteran botanist of this coast. Sometimes genera are named in honor of those who are not botanists, as Fremontia, Hollisteria, etc.

Specific Names are adjectives corresponding to the first parts of common names. They are usually descriptive of some characteristic of the plant, as *Gilia liniflora*, Flax-flowered Gilia. Frequently a species is named for the discoverer, as *Gilia Bolanderi*, Bolander's Gilia; often for the country where it was first found, or where it abounds, as *Ranunculus Californicus*, California Buttercup. Sometimes there are *varieties* of a species as *Trifolium barbigerum*, Var. *Andrewsii*, Andrews' Bearded Clover.

Orders and Classes. Genera are grouped in Orders or Families, and these in Classes. There are two classes of flowering plants, *Exogens* and *Endogens*.

ANALYSIS OF PLANTS.

This whole matter of naming and classifying can be well understood only after you have analyzed many plants; *i. e.*, you must have carefully examined them part by part, and patiently compared their peculiarities with the descriptions in the *Flora* until you have determined their names. In the beginning there will be many failures; but do not allow them to discourage you, for each victory will make the way easier to other conquests.

Choose for your first studies plants with large flowers. Do not attempt to determine the name of a plant unless you have specimens which show the kind of inflorescence and the arrangement of the leaves on the stem. If possible, secure specimens of the fruit and the roots. If in any plant you cannot readily distinguish the parts of the flower and their relations to each other, lay it aside until the study of easier plants has given you more skill.

The first thing to be determined in analyzing a plant is the Class; *i. e.*, you must decide whether it is an Exogen or an Endogen. You have learned in the preceding lessons how the seeds and stems of these two Classes of Flowering Plants differ. Usually, however, the leaves and flowers sufficiently distinguish the class. In our plants, if the leaves are parallel-veined; or, if the parts of the flower are in threes the plant is an endogen. In other words, if there is no network of intersecting fibers between the ribs of the leaves the plant is an endogen; if the flower has

three sepals and three petals (*i. e.*, a perianth of six leaves or lobes), three or six stamens and three or six pistils (generally united to form a compound pistil with a three or six-celled ovary) the plant is an endogen. When the leaves are netted-veined, and the parts of the flower are not all in threes, the plant is an exogen.

It is a good plan to write out a description of a plant before attempting to ascertain its name. The parts may be described in this order: Roots, Stems, Leaves, Flowers, Fruit.

You may find a smooth plant bearing a loose raceme of red flowers, one of which is represented in Fig. 57. The floral leaves are all colored, but there are evidently two sets; viz.: a calyx of 5 sepals inclosing a corolla of 4 petals. The parts of the flower, then, are not in threes; and, since the palmately lobed leaves are netted-veined the plant must be an exogen. Turning to the key, we proceed as follows:

The plant must belong in "DIVISION 1," since by carefully removing the sepals and petals we find that the latter are separate from each other. It must be found under "A," for there are many stamens. The stamens are free from the calyx and corolla, *i. e.*, they are hypogynous; so we read the next line: "Pistils, few to many distinct carpels, rarely one." Our flower has three distinct carpels, therefore we feel sure that it must be sought under one of the next five equal lines beginning with "Calyx." As the calyx is easily shaken off from the older flowers we decide that it is deciduous. The juice is colorless also. We turn, therefore, to RANUNCULACEÆ, p. 16. The description of the order is satisfactory. The key to the genera begins with the heading "**Flowers regular.*" Ours is not, for the upper sepal is unlike the others. "***Flowers irregular; colored sepals conspicuous,*" is right. We now choose between "Upper sepal spurred," and "Upper sepal hooded." Evidently the first is right, and the genus is *Delphinium*. We find that the generic description on p. 18 fits our plant. The last species being the only one with red flowers, we decide that our plant is *Delphinium nudicaule*, or the Naked-stemmed Larkspur.

The order Leguminosæ, or the Pea Family, is one that you will soon

learn, since its characteristics are well marked. We will suppose that you have before you a very common blue-flowered shrubby plant belonging to that order, a single flower of which is shown in Fig. 58. Knowing the order, you turn at once to p. 38, and begin to use the key to the genera.

Carefully removing all the petals, the stamens and pistil appear as in *a*, Fig. 59. The filaments are united for the greater part of their length into a tube which incloses the ovary as a sheath does a knife. Of the three sections in the key, then, it is evident that the second is to be taken. Since some of the anthers have shed their pollen, and others have not, it is safe to say they are of two kinds—a bud will show the difference better (*b*, Fig. 59.) Moreover the leaves are digitate, and have more than three leaflets. We therefore conclude that the third genus is the one. Our plant is slightly shrubby, so we pass over the first heading in the synopsis of species. Of the second and third headings the last seems the most likely to lead us aright. Our flower is blue, so we have to choose between the second and third species. The words “Slightly woody at the base,” decide us in favor of *Lupinus Douglasii*, though we should examine more specimens before being quite positive.

Fig. 60 represents a flower of a plant common in the Redwood forests. Three or more of the dull-colored flowers grow in an umbel on a very short scape between a pair of spreading radical leaves. Since the leaves have parallel veins, and the parts of the flower are in threes, we must use the Analytical Key for Endogens, p. 13. You will have no difficulty in referring the plant to the ORDER LILIA-

CÆ. To make the analysis of a plant in that large order easy, the genera are grouped in three Series. Reading the characteristics of SERIES I, we find they do not correspond with those of our plant, which has no floral bracts, which has the stamens hypogynous instead of perigynous, the anthers extrorse instead of introrse, etc. Comparing Series II with Series III, we decide that our plant belongs in the former, since the perianth is not persistent, and the flowers are not in racemes or panicles. § 1, in Series II is wrong, for our plant has no leafy stem. Since the perianth segments of our flower are dissimilar we try § 3, under which we refer our plant to the

60. Flower of *Sceloporus*. *a*, one of the stamens magnified, showing the bursting anther cells.

genus *Scoliopus*. Turning to the description of the only species described, we find it satisfactory. Upon referring to the Glossary of Generic and Specific Names in the back part of the book, we find why the plant was named *Scoliopus Bigelovii*.

This picture represents part of a plant whose yellow flowers are among the first to greet the new year. It is shown as it would appear if cut down through the center after removing most of the outer leaves. The leaves and flowers all grow from the flat summit of a thick root-stock. It will be noticed that the buds are younger as the center is approached. Possibly you have tried to analyze one of these flowers. If so, you probably got on nicely till you tried to find the ovary. I hope you kept searching and at last felt the satisfaction which rewards the discoverer. However, you can determine the name, and thus have the book tell you where the ovary is. The poorest eyes can see that the leaves are all radical; that the four divisions of the calyx are reflexed; that four broad petals and eight stamens grow upon it; and that there is one pistil whose slender style bears a globose stigma. You can not doubt that the plant is to be sought under B., in Division 1, but you are unable to say whether the ovary is superior or not. In such a case, search first for the order under the head "OVARY SUPERIOR;" and, if not satisfied there, try the head "OVARY AND FRUIT INFERIOR." Since there is but one pistil, you look under "*** Pistil only one." The plant is not a shrub, so you next stop at "++ Herbs." The first division under this is the only one admissible, because the leaves are all radical. But in no case under this head is the number of stamens eight. We therefore try the subhead "2. OVARY AND FRUIT INFERIOR," etc. It is evident that the descriptive line, "Parts of the flower mostly in 4's," etc., is the only one that fits our plant, so we turn to p. 59, where we find nothing in the description of the order Onagraceæ to rule our plant out. The lines descriptive of the genera are all unsuited to our plant, except one, which refers us to the genus *Cnothera*, the de-

Fig. A. *Clarkia elegans*; a, inferior, sessile ovary of the axillary flower. Fig. B. *Boissduvallia densiflora*; c, inferior ovary, sessile in the axil of a bract. Fig. C. Capsule of *Godetia*; b, cross section of the same. Fig. D. *Epilobium paniculatum*; h, inferior ovary; f, a grown capsule; g, tube of calyx above the ovary; e, one of the bifid petals; i, one of the seeds bearing a tuft of silken hairs.

The figure on the right represents *Cardamine paucisecta*, a pod of which is represented at e on the opposite page.

scription of which (p. 60) is satisfactory. Our plant is *acaulescent* or stemless; therefore, according to the book, the calyx tube is filiform (slender) above the underground ovary. This being verified by examination, there can be little doubt that the plant is *Ecnothera ovata*. You now see that the flowers, instead of growing upon scapes, are sessile upon the end of a root-stock. The apparent flower stem is the slender calyx tube and style consolidated. When you plucked the flower, the ovary was left under the ground. No wonder you could not find it. Later in the season you will find other plants belonging to this order; then the figures above will help you.

The figure at the right above represents the upper part of a plant which usually grows in moist places. The white flowers have four separate sepals; four petals; six stamens in two sets, two being shorter and otherwise different from the other four, and one pistil.

These characters lead you in the key to the order Cruciferae, but it is not easy to decide farther, because you have not the fruit. Look for the pods a few weeks later, and you will find them long and flat, as represented in the figure at *e* on the left. You can then determine the name of the plant. The seed pods here figured will help you in determining some of the plants in this order.

The curious flower depicted below is another early bloomer. You must cut the flower open and study it carefully. The four—sometimes five—petals are joined together, and bear upon the short tube the four stamens which hug the pistil tightly and form a beak like that of a bird. The ovary does not adhere to the calyx, and if a seed pod is partly grown, it will be easy to see that the seeds grow upon a central placenta. Turning to the key you are called upon to decide whether the stamens are opposite the lobes of the corolla or not. They certainly are opposite, so the order Primulaceae is evidently where our plant belongs. The pretty little foreigner *Anagallis* is here figured, and it will be

UPPER FIG.—*a*, indehiscent pod of *Raphanus raphanistrum*; *b*, pod (silicle) of *Capsella bursa-pastoris*; *c*, pod of *Capsella divaricata*; *d*, pod (silique) of *Tropidocarpum*, flattened contrary to the partition; *e*, pod of *Cardamine paucisecta*, flattened parallel with the partition (septum); *f*, two pods (silicle) of *Lepidium nitidum*, and two partitions from which the valves have fallen, showing that there was one seed in each cell; *g*, pod of *Lepidium latipes*, showing the broad pedicel which suggested the specific name; *h*, a branch of *Thysanocarpus pusillus*, with four of its 1-seeded pods; *i*, one of the pods magnified to show the hooked hairs; *j*, pod of *Thysanocarpus curvipes*.

LOWER FIG.—*c*, reflexed petals of *Dodecatheon meadia*; *f*, filaments; *a*, anthers; *s*, stigma (not always protruding); *i*, involucre; *p*, scape (radical peduncle). The horizontal figure represents a rather small branch of *Anagallis arvensis*.

a. Perianth of *Brodiaea capitata* laid open, with pistil and section of mature capsule. b. Two segments of the perianth of *B. lactea* and the pistil. c. Perianth and pistil of *B. laxa*. d. Bud and flower of *B. terrestris*. e. Same with perianth laid open. f. The pistil.

the staminodia (opposite the outer segments of the perianth) are not petaloid, but resemble true stamens. Observe that the first species is distinguished by staminodia not notched at the top as shown in the figure. The species in § *Senbertia* resemble the first three in general appearance, but the stamens and pistils are very different, as is shown by Fig. c. Observe that the stamens have versatile instead of basifixed anthers; and the ovary is upon a stipe, instead of being sessile. Douglas' *Brodiaea*, of Oregon, is like Fig. c, only the base of the perianth is broader, the upper row of stamens have broad bases, the stipe is shorter and the flowers are on short pedicels, so as to form a sub-capitate umbel. The most common species of the third section is the White *Brodiaea*. Fig. b shows a part of the flower.

The middle figure on the next page represents a plant, the curious cup-like leaves of which must have attracted your attention. The leaf cups are frequently much larger than here shown, and borne upon stems a foot or more in height. Though the flowers are small,

well to read the description of *Trientalis*, that you may know it when found.

When you get a head of the purple-blue flower; of *Brodiaea capitata*, figured on page xxiv of this book, it will be the proper time to study the figures on this page, and what is here said about the genus they illustrate.

Upon p. 113 you will find the species grouped under three sub-genera or sections. Figures a, d, and e illustrate the first, c the second, and b the third. The species belonging to the first section are arranged under two heads marked by asterisks, and those under the first head are under subheads marked by daggers. Species 4 and 5 closely resemble number 6, which is put under a different head, because it has six true or anther-bearing stamens instead of three stamens and three staminodia. Fig. a shows that three of the filaments came near being antherless. Petaloid staminodia replace these small stamens in species 4 and 5, and the fertile stamens are without the winglike appendages shown in Fig. a. Observe that the staminodia in one of these species are cleft. The first three species have flowers resembling the one shown in Figs. d and e, in which

you readily decide that the sepals are two, and that there are five petals and five stamens. The seed pods show that there is but one pistil, and that the calyx does not adhere to the ovary; that is, the ovary is superior. Armed with this information, you turn to the key where you search under "B. STAMENS 10 or less." Evidently the correct subheads are: "1. Ovary, or ovaries, superior," etc.; "* * Pistil only one;" "+ + Herbs;" "+ Leaves mostly radical;" "Stamens 5, opposite the petals; sepals 2; style 3-cleft—Portulacaceæ, 29." Turning to p. 29 you find that *Claytonia* is the only genus having 5 stamens, and that this plant must be *Claytonia perfoliata*.

The little plant figured above (a) evidently answers to the description of the Var. *exigua*, which is now considered by the best authority to be a distinct species. The stem leaves are sometimes broad and united at the base. The radical leaves are nearly terete, as shown in the figure. This species is most obviously distinguished from the two varieties of the Cup-leaved Claytonia, by its glaucous leaves. The plants are often smaller than here represented, and rarely much larger.

Kellogg's *Lavatera*, or Tree Mallows, an ever-blooming shrub, common in cultivation, is a constant source of material with which to illustrate the Mallows Family. The figure at the bottom of the page represents one of the flowers cut through the center, so as to show the structure. The fruit of a very common weed of the same family is also shown. The most common native plant is *Sidalcea humilis*, described on page 32. Hollyhock, cotton, okra and *Abutilon* are foreign plants of this order, common in cultivation. The latter is a shrub with drooping flowers; the petals incurved, and the stamens sticking out (exserted).

UPPER FIG.—a. *Claytonia exigua* (entire plant). b. *Claytonia perfoliata*.

LOWER FIG.—a. Fruit of *Malva rotundifolia*. b. Same, showing the bracts of the persistent calyx. c. Kellogg's *Lavatera*. (L. assurgentiflora.)

Amsinckia lycopsoides. *a*. Calyx spread apart to show the ripe akenes.

You may recognize in the picture on this page the likeness of one of our most troublesome native weeds. The yellow flowers are often smaller than here represented, and the upper leaves are generally narrower. Indeed, this plant, along with many others of this coast, is provokingly variable in its appearance. Pull off a corolla, and a single undivided style is uncovered. Follow this down into the calyx, and you discover that it grows from between four seed-like ovaries. These are more easily seen in an older calyx, as shown at *a*. Now it happens that this peculiar compound ovary, together with the coiled inflorescence, belongs only to plants of the order Boraginaceæ. A coiled inflorescence and a pistil with a divided style is found only in plants of the order Hydrophyllaceæ. Any plant with a four-parted ovary and regular flowers may be sought under the former order. Creeping Heliotrope or Blue Weed (*Heliotropium Curassavicum*) is a Boraginaceous plant with ovaries merely 4-lobed. The Mint Family has fruit similar to that of the Borrages (see *d* and *e* in the figure on p. 11), but the flowers are irregular. The Verbenas are distinguished from the Mints by nearly regular flowers and a 4-lobed ovary, which does not split into parts

until quite ripe. (See *a* in the left-hand figure on page 11.)

The plant figured at the top of the opposite page is common in open woods throughout the Coast Ranges and the foot-hills of the Sierra Nevada. The flowers are white, tinged with purple. Each of the three incurved petals is covered with hairs on the inner side, and is marked near the base by a depression which is seen upon the outside as a projecting boss. This is called a gland, and is one of the characteristic marks of the genus. Since the three-cornered ovary is superior, we at once refer the plant to the order Liliaceæ, where we again read the characters given in each of the three series. The stamens in this plant are hypogynous, not perigynous, and the anthers are extrorse. Therefore, SERIES I is passed. SERIES III is excluded, because the anthers in this plant are not versatile. Evidently the name is to be sought under SERIES II, which is divided into three sections. You now see why you should have dug up one of the plants. However, you can decide the genus without knowing that the plant is bulbous. It can not belong to § 3, since one of the two genera under it has umbellate flowers, and the other solitary flowers. In § 2, the perianth segments are similar. Our plant then must be sought in § 1, and under the head “* * Perianth segments unlike,” which leads to *Calochortus*,

UPPER FIG.—Flower and buds of *Calochortus albus*, and the three-winged fruit outlined.

RIGHT-HAND FIG.—*a*. Flower of *Sphacele calycina*. *b*. Same with corolla cut to show stamens, pistil, and hairy ring inside. *c*. Fruit (4 globular akenes) of the same, lying in the bottom of the calyx. *c*. Flower and buds, showing inflorescence of *Trichostema lanceolatum*. *d*. Ripe fruit of the same (4 triangular akenes in the persistent calyx).

LEFT-HAND FIG.—*Verbena hastata* (spikes and bracts). *a*. Ripe fruit removed from the calyx (natural size and magnified).

p. 117. The subglobose and nodding flowers place it in the first division of § 1, *Eucalychortus*. Our plant is the white species. The yellow species has larger flowers. The stiffly erect, open flowers of § 2 of this genus have a markedly different appearance from the species here figured; yet their structure is similar. The spots upon the petals cause them to

resemble the wings of butterflies; hence the common name Butterfly Tulip, and the section name *Mariposa*.

DIRECTIONS.

Analyze the plant first as directed on page 4 of the West Coast Key. Make the following changes in Flora to correspond with the Key. The numbers indicate pages

17. *Thalictrum Fendleri* is *T. polycarpum*.
18. *Ranunculus macranthus* is *R. orthorhyncus*.
25. *Lepidium Menziesii*, var. *strictum* is *L. strictum*.
25. *Thysanocarpus pusillus* is *Athysanus pusillus*.
26. *Viola aurea* is *V. præmorsa*.
30. *Claytonia perfoliata*, var. *exigua* is *C. exigua*.
- “ “ “ var. *spathulata* is *C. spathulata*.
32. *Sidalcea humilis* is *S. malvæflora*.
41. *Lupinus micranthus*, var. *trifidus* is *L. trifidus*.
43. *Trifolium amplexans* is a var. of *T. depauperatum*.
48. *Astragalus didymocarpus* is partly *A. nigrescens*.
49. *Lathyrus venosus*, var. *Californicus* is *L. Californicus* and partly *L. Bolanderi* of the Key.
51. *Spiræa* is *Holodiscus* and *Neilia* is *Physocarpus*.
66. *Plectritis* is *Valerianella* with same specific names.
74. *Asclepias fascicularis* is *A. Mexicana*.
- “ *Gomphocarpus purpurascens* is *Schiznotus purpurascens* and should be called *Towle's Milkweed* in honor of the discoverer, C. B. Towle.
75. *Gentiana affinis* var. *ovata* is *G. ovata*.
77. *Gilia divaricata* is *G. glutinosa*; *G. Sessei* is *G. heterophylla*.
82. *Phacelia tanacetifolia* is partly *P. distans*.
85. *Eritricium Californicum* is *Krynitzkia Californica*; *E. Scouleri* is *K. Scouleri*; *E. Chorisianum* is *K. Chorisiana*; *E. oxycaryum* is *K. oxycarya*; *E. fulvum* is *Plagiobothrys nothofulvus*; *E. canescens* is *P. canescens*.
87. *Convolvulus luteolus* is only a form of *C. occidentalis*.
- 88b. *Solanum nigrum*, var. *Douglasii* is *S. Douglasii*.
93. *Mimulus pilosus* is *M. exilis*.
95. *Orthocarpus faucibarbatulus* is *O. erianthus*, var. *lævis*.

Why these changes should be made is “too long a story.”

ANALYTICAL KEY.

The calyx and corolla together of either more or less than six parts* **CLASS I**

The calyx and corolla together of 6 parts:

Stamens 6 or less **CLASS II**

Stamens 9; Umbellularia, p. 106, or Eriogonum, 105

Stamens 10; united sepals 5 Leguminosæ, 38

Stamens many; caducous sepals 2 Papaveraceæ, 20

Stamens many; sepals 3 Sagittaria, 122

CLASS I.—EXOGENS OR DICOTYLEDONS.

Calyx and corolla both present.

Petals not united (free) Division 1

Petals more or less united (cohering) Division 2

Corolla wanting; calyx often petaloid, sometimes wanting Division 3

DIVISION I.—POLYPETALÆ.

A. Stamens more than 10 and more than double the number of petals.

1. **HYPOGYNOUS**, *i. e.*, on the receptacle (not adhering to the sepals or petals).

** Pistils few to many distinct carpels, rarely one.*

Calyx deciduous, sepals 5 Ranunculaceæ, 16

Calyx caducous, sepals 2 or 3 Papaveraceæ, 20

Calyx persistent, sepals 3 or 4; aquatic plants Nymphæaceæ, 20

Calyx persistent; leaves all radical Rosaceæ, 48

Calyx petaloid; corolla wanting Ranunculaceæ, 16

** Pistil one and compound, as shown by two or more stigmas, or more than one cell in the ovary.*

Petals more numerous than the sepals.

Indefinitely numerous, slender, persistent; aquatic plants Nymphæaceæ, 20

Just twice as many (4-6); sepals caducous Papaveraceæ, 20

Five to sixteen; sepals persistent; fleshy herbs Portulacaceæ, 29

* *Malvastrum* (see p. 115) has a 4-parted perianth; 4 stamens and 2 or 3 parallel-veined leaves.

Petals of the same number (5) as the persistent sepals, yellow.

- Leaves opposite; sepals equal.....**Hypericaceæ**, 30
 Leaves alternate; 2 outer sepals smaller.....**Cistaceæ**, 25

2. PERIGYNOUS or EPIGYNOUS (on the free or adnate calyx).

- Leaves opposite, simple; fleshy herbs.....**Ficoideæ**, 63
 Shrubs. Sepals and petals numerous.....**Calycanthaceæ**, 55
 Sepals and petals 4 or 5.....**Saxifragaceæ**, 55
 Leaves alternate, with stipules.....**Rosaceæ**, 49
 Without stipules; rough herbs.....**Loasaceæ**, 62

3. ON THE CLAWS OF THE PETALS.

- Stamens free; calyx a cap; petals 4.....**Papaveraceæ**, 20
 Stamens many united to form a tube; petals 5.....**Malvaceæ**, 31
 Stamens 10 to 16 united for half the length; petals 5-8.....**Styracaceæ**, 20

B. Stamens 10 or less.

1. OVARY or OVARIES SUPERIOR (free from the calyx), or mainly so, but sometimes included in the calyx-tube.

* *Pistils more than one and distinct (not united).*

Pistils of the same number, as petals and the sepals.

- Leaves simple entire, fleshy.....**Crassulaceæ**, 58
 Leaves pinnate; styles united.....**Geraniaceæ**, 33

Pistils not corresponding in number with the petals and sepals.

- Two, united at the base. Trees with compound leaves.....**Sapindaceæ**, 37
 Herbs with simple leaves.....**Saxifragaceæ**, 55
 Many. Stamens on the receptacle.....**Ranunculaceæ**, 16
 Stamens on the calyx.....**Rosaceæ**, 49

* * *Pistil only one.*

† *Shrubs or trees.*

Style and stigma one.

- Sepals, petals, and stamens 6 each, in 3's opposite each other..**Berberidaceæ**, 19
 4 to 5 each; leaves 3-foliate, alternate..**Rutaceæ**, 34
 5 each; leaves simple, opposite.....**Celastraceæ**, 35
 Calyx 2-lipped; petals unequal; stamens 5-8, exserted.....**Sapindaceæ**, 37
 Calyx 4-toothed; petals 2; stamens 2-4; fruit a samara.....**Oleaceæ**, 73

Styles or stigmas more than one.

- Styles 2; leaves opposite; fruit 2-winged.....**Sapindaceæ**, 37
 Style 3-cleft; stamens 5, opposite the small petals.....**Rhamnaceæ**, 35
 Stigmas 3; leaves alternate 3-foliate.....**Anacardiaceæ**, 38
 Stigma 5-lobed; a small shrub with opposite or whorled leaves.....**Ericaceæ**, 68

DIVISION 2. GAMOPETALÆ.

A. Ovary Inferior (adherent to the calyx) or largely so.

Stamens more numerous than the lobes of the corolla, 8 or 10.

Distinct and free from it, or nearly so.....**Ericaceæ**, 68

Stamens as many as the lobes of the corolla (5, rarely 4), united into a tube.

Flowers in an involucrate head, resembling a single blossom.....**Compositæ**, 66

Flowers separate in racemes or spikes; ovary slender**Lobeliaceæ**, 67

Stamens as many as the corolla-lobes, distinct.

Nearly or quite free; leaves alternate, no stipules....**Campanulaceæ**, 67

Inserted on the corolla; leaves opposite or whorled.

With stipules, or in whorls, entire**Rubiaceæ**, 65

Without stipules, opposite. Calyx with minute lobes...**Caprifoliaceæ**, 64

Prostrate herbs. *Abronia* in.....**Nyctaginaceæ**, 104

Stamens only 3, fewer than the lobes of the corolla.

Leaves opposite; stamens distinct; flowers minute**Valerianaceæ**, 66

Leaves alternate; stamens united; fruit prickly.....**Cucurbitaceæ**, 63

B. Ovary Superior (free from the calyx) or nearly so.**1. FLOWERS REGULAR** or nearly so.

* *Stamens, twice as many as the lobes of the corolla.*

Stamens 8-10, distinct; corolla campanulate or ovoid.....**Ericaceæ**, 68

Filaments united for half their length; corolla nearly polypetalous....**Styrax**, 20

Pistils or styles as many as the petals; fleshy herbs.....**Crassulaceæ**, 58

** *Stamens as many as the lobes of the corolla and opposite them.*

Styles 5; long-clawed petals, scarcely united.....**Flumbaginaceæ**, 71

Style 1; corolla lobes, reflexed or rotate.....**Primulaceæ**, 72

*** *Stamens as many as the lobes of the corolla and alternate with them.*

Style and stigma one, leaves entire (lobed in the first).

Leaves mostly radical; flowers on a scape.....*Romanzoffia* in **Hydrophyllaceæ**, 80

Leaves all radical; flowers in a spike; 4-lobed corolla scarious....**Plantaginaceæ**, 103

Leaves alternate; flowers mostly in coiled spikes; ovary 4-lobed....**Borraginaceæ**, 83

Leaves alternate; flowers rotate to funnelform; ovary 2-celled.....**Solanaceæ**, 88

Leaves opposite; flowers in cymes; ovaries 2.....**Apocynaceæ**, 73

Leaves opposite or whorled; flowers in umbels; ovaries 2....**Asclepiadaceæ**, 73

Style 1 or none, stigma 2.

Leaves opposite or whorled, sessile, entire, or..... } **Gentianaceæ**, 74

Leaves alternate, 3-foliate, on a creeping rootstock }

Leaves alternate; twining vines; flowers funnellform, axillary.....	Convolvulaceæ , 86
Leaves alternate; flowers not axillary.....	Hydrophyllaceæ , 80
Leaves alternate; flowers in a head, with acerose bracts.....	<i>Gilia</i> , § 5, 78
Style 2-cleft.....	Hydrophyllaceæ , 80
Style 3-cleft, or stigmas 3.....	Polemoniaceæ , 75
Style 2; leaves simple or none.	
Flowers solitary in the axils of small leaves.....	} Convolvulaceæ , 86
Flowers clustered on filiform parasitic stems.....	
Flowers in naked cymose clusters; shrubs.....	Hydrophyllaceæ , 80
* * * * <i>Stamens fewer than the lobes of the slightly irregular corolla.</i>	
<i>Limosella</i> or <i>Veronica</i> in.....	Scrophulariaceæ , 93

2. FLOWERS IRREGULAR. Stamens with anthers 4 in pairs or 2; style 1; leaves opposite or none, except in some of the *Scrophulariaceæ*.

Ovary 1-celled; corolla curved; leafless root parasites.....	Orobanchaceæ , 96
Ovary 2-celled.....	Scrophulariaceæ , 89
Ovary 4 parted, forming in fruit 4 seedlike nutlets.....	Labiataæ , 97
Ovary 4-lobed; fruit splitting into 4 nutlets.....	Verbenaceæ , 102

DIVISION 3. APETALÆ.

A. Ovary inferior (calyx adherent) or apparently so.

Leaves cordate; calyx 3-lobed; capsule 6-celled.....	Aristolochiaceæ , 104
Leaves opposite; calyx salver-form; ovary 1-seeded.....	Nyctaginaceæ , 104
Leaves opposite; calyx inconspicuous; corolla tubular.....	Caprifoliaceæ , 64

B. Ovary superior (free from the calyx).

* *Herbs; leaves alternate.*

Petaloid calyx withering-persistent; akene 3-cornered or flat.....	Polygonaceæ , 105
Petaloid sepals deciduous; carpels several.....	Ranunculaceæ , 16
Sepals 4, green, deciduous; small pods 2-celled.....	Cruciferaæ , 22
Flowers asepalous in a spike, with a petaloid involucre.....	Anemopsis , 106

* * *Herbs; leaves opposite, entire.*

Capsule 1-celled; style and stigma 1; leaves fleshy.	
Stems prostrate; flowers in involucrate heads.....	Nyctaginaceæ , 104
Stems erect; flowers axillary.....	<i>Glauz</i> in Primulaceæ , 73
Capsule 1-celled; style or stigmas, 3 or more.....	Caryophyllaceæ , 27
Capsule 3-5-celled; flowers axillary.....	<i>Mollugo</i> in Ficoideæ , 63

* * * *Shrubs or trees; leaves alternate, entire (except in the last).*

Calyx tubular, bearing the stamens; akene tailed.....	Rosaceæ, 49
Calyx 6-parted, yellowish; leaves aromatic.....	Lauraceæ, 106
Calyx 4-5-cleft, greenish; fruit cherry-like.....	Rhamnaceæ, 35
Calyx 3-4-cleft, yellowish; stamens 6-8.....	Thymelaceæ, 107
Calyx 5-cleft, bright yellow; stamens 5, united.....	Sterculiaceæ, 20

* * * * *Trees; leaves opposite, pinnate.*

Fruit a slender samara.....	Oleaceæ, 73
Fruit a double samara.....	Sapindaceæ, 37

* * * * * *A half-woody climber; leaves opposite.—Clematis, 16.*

CLASS II.—ENDOGENS OR MONOCOTYLEDONS.

A. Perianth adherent to the ovary (ovary inferior).

Flowers irregular. Anthers 1 or 2 on the pistil.....	Orchidaceæ, 108
Flowers regular. Stamens 3, anthers extrorse.....	Iridaceæ, 110

B. Perianth free (ovary superior).

Flowers in whorls. Carpels 8 to many.....	Alismaceæ, 108
Pistil 3-celled; stamens 3 to 6.....	Liliaceæ, 110
Flowers greenish in a spike.....	<i>Triglochin</i> in Alismaceæ, 108
Perianth 4-parted; stamens 4. Stem 2-3-leaved.....	<i>Maianthemum</i> , 115
Pistil 2-celled; red flowers in an umbel.....	<i>Clintonia</i> , 119

BOTANY

OF

WEST-CENTRAL CALIFORNIA.

SERIES I.

FLOWERING OR PHÆNOGAMOUS PLANTS.

Plants producing flowers and seeds; the former consisting, at least, of stamens and pistils, which may be together in the same flower, or they may separately form staminate and pistillate flowers growing on the same individual, or different individuals of one species; the latter containing a germ, or embryo.

CLASS I.—EXOGENS OR DICOTYLEDONS.

Stems consisting of pith in the center, bark on the outside, and between these, fibrous or woody tissue, which, in perennial stems, increases from year to year by the addition of layers on the outside next the bark. Embryo usually of two opposite cotyledons, or rarely with several in a whorl.

SUB-CLASS I.—ANGIOSPERMS.

Pistil consisting of a closed ovary which forms the fruit. Cotyledons two.

DIVISION I. POLYPETALÆ.

ORDER 1. RANUNCULACEÆ.

Herbs or shrubs, with colorless juice; foliage various; stipules none; organs of the flower free and distinct; sepals, petals, and pistils few or many; stamens numerous; petals sometimes wanting, then the sepals are usually petaloid; anthers short and adnate; seeds with minute embryos in fleshy albumen.

** Flowers regular.*

Petals none; shrubby climbers.....	Clematis.	1
Petals none; small herbs.....	Anemone.	2
Petals 5 or more; carpels numerous.....	Ranunculus.	3
Petals 5, spurred; carpels 5.	Aquilegia.	4

** * Flowers irregular; colored sepals conspicuous.*

Upper sepal spurred.....	Delphinium.	5
Upper sepal hooded.....	Aconitum.	6

** * * Sepals large, leaf-like, persistent.*

Flowers large.....	Pæonia.	7
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1. CLEMATIS, L. VIRGIN'S BOWER.

Sepals 4, colored and petal-like, valvate in the bud. Pistils numerous; styles persistent, becoming long feathery tails in fruit. Half-woody climbers or perennial herbs, with opposite leaves.

1. *C. ligusticifolia*, Nutt. Stems climbing by the petioles of the 5-foliolate leaves; leaflets broadly ovate to lanceolate, $1\frac{1}{2}$ to 3 inches long, acute or acuminate, 3-lobed and coarsely toothed, rarely entire or 3-parted. Flowers dioecious, paniculate; sepals thin, silky, white, 4 to 6 lines long; akenes pubescent; tails 1 to 2 inches long.

Var. *Californica*, Watson. Leaves silky-tomentose beneath, often small.

2. *C. lasiantha*, Nutt. Leaves 3-foliolate; leaflets ovate, 1 to $1\frac{1}{2}$ inches long, acute, coarsely toothed or 3-lobed or the terminal 3-parted. Flowers solitary on 1-2-bracted peduncles; sepals obtuse, thick, 6 to 10 lines long.

2. ANEMONE, L.

Sepals 4 to 20, colored and petal-like, imbricated in the bud. Petals none. Pistils numerous; style short; stigma lateral; akenes compressed, pointed, in a head. Erect perennial herbs, with lobed or divided leaves, which are radical, except those which form an involucre below the flower.

1. *A. nemorosa*, L. (WOOD ANEMONE.) Smooth or somewhat villous; stems from a slender rootstock, 3 to 12 inches high, without radical leaves, one-flowered; involucre of 3 petioled ternate leaves, the divisions cuneate-oblong to ovate, incisely toothed or lobed, or the lateral ones 2-parted, about an inch long; the 4 to 7 sepals pinkish or white; akenes 12 to 20, oblong, with a hooked beak.

Here belongs *Thalictrum Fendleri*, Englm. A smooth apetalous diœcious herb; also, *Myosurus minimus*, L. A very small herb, with a tuft of linear or spatulate entire radical leaves, and solitary flowers on simple scapes; called *Mouse-tail*, from its long, narrow receptacle, densely covered with small akenes.

3. RANUNCULUS, L. BUTTERCUP.

Sepals usually 5. Petals 3 to 18. Pistils numerous. Akenes in a head, usually flattened, beaked with the persistent style.

§ 1. *Aquatic herbs; petals white, with a pit at the base, the claw yellow; akenes transversely wrinkled.*

1. *R. hederaceus*, L., var. Glabrous; stems 6 to 12 inches long, floating; leaves commonly all floating, 3 to 8 lines wide, deeply 3-lobed, truncate or cordate at the base; the lobes equal, oval or oblong, the lateral ones usually with a broad notch in the apex; submersed leaves none or rudimentary and resembling adventitious roots; peduncles opposite the upper leaves, thicker than the petiole, 6 to 8 lines long; sepals a line long; petals 2 lines long, obovate oblong; stamens 5 to 9; akenes 4 to 6.

2. *R. aquatilis*, L., var. *tricophyllus*, Chaix. Stems long, filiform; leaves all submersed and cut into numerous capillary segments, which are 4 to 10 lines long; flowers 3 to 5 lines in diameter; akenes numerous in a globular head.

§ 2. *Terrestrial herbs, but often growing in wet places; sepals green; petals yellow, with a scale at the base; akenes neither wrinkled nor hispid.*

* *All the leaves undivided, the margins entire.*

3. *R. Flammula*, L., var. *reptans*, Gr. Glabrous throughout; stems filiform, creeping and rooting at the joints, 4 to 10 inches long; leaves mostly lanceolate and acute at each end, entire; flowers 2 to 5 lines in diameter; petals broadly obovate, one half longer than the sepals; akenes few, in a small globular head, plump, smooth; beak very short and curved.

4. *R. alismæfolius*, Geyer. Similar to the last species, but with stoutish, erect stems, longer flowers and obtuse leaves; akenes straight-beaked.

* * *Some or all the leaves ternately compound.*

5. *R. Californicus*, Benth. More or less hairy; stems erect, or nearly so, 12 to 18 inches high; radical leaves, commonly pinnately ternate, the leaves laciniately cut into 3 to 7 parts, which are usually linear; flowers bright yellow, 5 to 10 lines in diameter;

petals 10 to 14, narrowly obovate; sepals shorter than the petals, reflexed; akenes nearly 2 lines long, flat, with sharp edges; beak short and curved; heads compact, ovate or globular.

This is by far the most common species, and usually the only one collected by beginners. It varies greatly. The leaves are sometimes simply three lobed and sometimes much cut up. [*R. Bloomeri*, Wat., belongs here. See p. 122.]

6. *R. macranthus*, Scheele. Stems stout, 2 to 5 ft. high; flowers 14 to 18 lines in diameter; petals commonly 5 or 6, broadly obovate, shining yellow.

§ 3. *Akenes rough; otherwise as in § 2.*

7. *R. hebecarpus*, Hook. & Arn. Rather slender, more or less hairy; flowers minute; petals 5, not more than a line long; sepals hairy, about equaling the petals.

8. *R. muricatus*, L. Smooth; flowers 5 or more lines in diameter; akenes large and rough, with recurved beaks. Introduced from Europe.

4. *AQUILEGIA*, Tourn. COLUMBINE.

Sepals 5, regular, colored and petal-like; petals 5, produced backward (upward) into a long tubular spur; stamens numerous, exserted, the inner ones reduced to thin scales; pistils 5; styles slender. Flowers nodding, showy, terminating the branches.

1. *A. truncata*, Fisch. & Mey. Stems 1 to 3 ft. high; flowers usually red, tinged with orange or yellow; leaves usually ternately compound, leaflets lobed.

5. *DELPHINIUM*, Tourn. LARKSPUR.

Sepals 5, colored and petal-like, very irregular, the upper one prolonged backwards at the base into a long spur, which (in our species) contains spur-like prolongations of the upper pair of petals. Petals 4, small and irregular. Stamens many. Pistils 1 to 5. Erect herbs, with palmately-cleft, lobed, or dissected leaves, and racemose flowers.

1. *D. simplex*, Dougl. Canescent throughout, with a fine, short, somewhat woolly pubescence, rarely smooth; stem stout and strict, 1 to 3 ft. high, leafy; leaves all much dissected with linear obtuse lobes, on stout, erect petioles; racemes usually dense and many-flowered, the pedicels often short and nearly erect; flowers small, blue, varying to nearly white or yellowish; sepals 4 or 5 lines long, about equaling the stout, straight spur; ovaries and capsule pubescent.

2. *D. variegatum*, Torr. & Gr. Foliage similar to the last, but the flowers much larger, on longer pedicels, forming a short, open raceme; ovary and capsule pubescent.

3. *D. decorum*. Fisch. & May. Lower leaves 5-lobed, sparingly toothed, the upper with narrow divisions. Flowers similar to the last, but the spur is usually longer, and the ovary and capsule smooth.

4. *D. Californicum*, Torr. & Gr. Stems stout, 2 to 7 ft. high; leaves large, 3 to

5 cleft, the divisions variously lobed; pedicels and dull bluish flowers densely velvety pubescent.

D. nudicaule, Torr. & Gr. Distinguished by its red flowers.

6. ACONITUM, Tourn. MONKSHOOD.

Sepals 5, colored and petal-like, very irregular; the upper one arched into a hood or helmet, which conceals the spur-like blades of the upper pair of petals. General appearance similar to *Delphinium*.

1. **A. Columbianum**, Nutt. Sufficiently characterized by the generic description. Rare.

7. PÆONIA, L.

Sepals 5, herbaceous. Petals 5 to 10. Stamens inserted on a fleshy disk. Pistils 2 to 5. Fruit leathery follicles. Perennial herbs with compound leaves.

1. **P. Brownii**, Dougl. Leaves thick, 1-2-ternately compound, the leaflets ternately and pinnately lobed, glaucous; petals leathery, dull, dark red, about equaling the sepals.

ORDER 2. BERBERIDACEÆ.

Shrubs or herbs, with compound alternate exstipulate leaves; flowers remarkable for having the bracts, sepals, petals and stamens before each other, instead of alternating.

Low shrubs, with rigid pinnate leaves and small yellow flowers.....**Berberis**. 1

A fern-like herb, with white flowers.....**Vancouveria**. 2

1. BERBERIS, L. BARBERRY.

Sepals, petals, and stamens 6 each, with 3 or 6 bractlets. Carpel 1, forming a berry. Smooth shrubs, with yellow wood, and yellow flowers in bracteate racemes.

* *Leaflets pinnately veined.*

1. **B. repens**, Lindl. Less than a foot high; leaflets 3 to 7, ovate, acute, 1 to 2½ inches long, not shiny above; short racemes terminating the stems.

2. **B. Aquifolium**, Pursh. 2 to 4 ft. high; leaflets 7 or more, the lower pair distant from the stem, 1½ to 4 inches long, shining above, spiny; racemes chiefly clustered in subterminal axils.

3. **B. pinnata**, Lag. Like the last species, but the leaves more crowded, and the lower pair of leaflets near the base of the petiole; usually 5 to 7 leaflets.

* * *Leaflets palmately nerved.*

4. **B. nervosa**, Pursh. Simple stems but a few inches high; leaves 1 to 2 ft. long, of 11 to 17 leaflets.

2. **VANCOUVERIA**, Morren & Decaisne.

Sepals and petals 6 each, reflexed, with 6 to 9 bractlets. Stamens 6. Carpel 1; the stigma cup-shaped. A slender perennial herb, with radical 2-3-ternately compound leaves, and the open paniculate raceme upon a naked scape.

V. hexandra, Morr. & Dec. The long petioled leaves rising like the fronds of a fern, leaflets 1 to 2 inches broad, petiolulate, obtusely 3-lobed, the margin thickened; the minute flowers on a scape exceeding the leaves.

ORDER 3. **NYMPHÆACEÆ.**

Aquatic perennial herbs, with peltate or deeply cordate leaves; solitary axillary perfect flowers on long peduncles. Stamens numerous.

Water-Shield. (*Brasenia peltata*, Pursh.) May be found in ponds. Its elliptical, peltate, floating leaves (green above and brownish-red beneath) and its jelly-coated stems characterize it quite well enough.

The *Yellow Pond-Lily* (*Nuphar polysepalum*, Engl.) is more common.

The Order **Sarraceniaceæ** is represented by the remarkable *Darlingtonia Californica*, or California Pitcher Plant, which grows in cold swamps in the northern part of the State, from Mount Shasta to near the coast.

Frankenia grandifolia grows in saline soils, and may be known by its opposite sessile, obovate, or linear oblanceolate, small leaves, with revolute margins; and by its small, pink flowers. It may be distinguished from a *Silene*, which at first it seems to be, by its fewer (4 to 7) stamens and sessile flowers.

The Order **Frankeniaceæ** should come next to *Caryophyllaceæ*. *Fremontia Californica*, belonging to the Order **Sterculiaceæ**, which is allied to the **Malvaceæ**, is most conveniently described here also. It is a small tree, bearing conspicuous yellow flowers in the axils of usually broadly cordate, lobed leaves. The apetalous flowers are sometimes 2 or 3 inches across.

The Order **Capparidaceæ** is represented in Santa Barbara County, and southward, by *Isomeris arborea*, a low shrub, bearing bracteate racemes of yellow flowers, the pistils conspicuous on account of their long stipes. The flowers of this plant are apparently like those of the **Crucifereæ**, and its proper place is next to that order. Capers are obtained from a cultivated plant of this order.

The Order **Styracaceæ** is represented by *Styrax Californica*, a pretty shrub, bearing clusters of nearly rotate white flowers, in which the gamopetalous corolla is cut down to the short tube which is adnate to the tube formed by the stamens: Calyx truncate.

ORDER 4: PAPAVERACEÆ.

On the left above is represented an opening bud of *Eschscholtzia*. The cap-like calyx has been split at the bottom and shoved upward by the expanding petals. Next to this

bud is an open flower of *Meconopsis* and one of its nodding buds. Behind the flower, and projecting above it to the right, is a stem from which the petals have just fallen. The slender filaments bending to one side, as they often do, show the curious pistil which in time becomes the pretty fluted capsule seen below. To the right of the *Mecconopsis* pod is the three-sided capsule of *Platystigma linearis*. The stem should have a few hairs upon it. The two flowers with hairy stems, the nodding buds below, and the rough seed pod above, belong to *Platystemon*. Observe the three caducous sepals, just ready to drop from the opening bud. The smooth plant on the right is *Platystigma Californicum*. If you choose you may call this the Smooth *Platystigma*, and the other species, with the triangular pod, Hairy *Platystigma*. The exceedingly prickly Bristly *Argemone* is represented on the right, below, by a bud and a couple of bracts. A pistil with its white prickles is imperfectly shown against one of the bracts.

The Order **Papaveraceæ** is characterized by flowers with 2 or 3 caducous sepals,

twice as many free petals in two sets, indefinite, usually numerous, free stamens, and a compound pistil. In *Eschscholtzia* the sepals are united, and the stamens adhere to the claws of the petals.

This small but interesting order of plants, with the exception of one species, is confined to the northern hemisphere. Fifteen species, belonging to eleven genera, are natives of the United States, and several European species have become naturalized. *Eschscholtzia* and *Platystemon* are the most widely distributed of the California genera.

Romneya Coulteri is a half shrubby plant, with smooth pinnatifid leaves and very large white flowers (3, 4, or even 6 inches across), a native of the coast from San Diego to Santa Barbara County.

Arctomecon is another white-flowered plant, with somewhat hairy, nearly entire leaves; the petals persistent; found in south Nevada and Utah.

Canbya, a recently discovered plant of south-east California, is the smallest of the order, being scarcely an inch in height. The small white petals are persistent.

Papaver Somniferum, a native of Asia, furnishes opium, which is the dried juice of the plant. A variety of this species is cultivated in this State for the seeds, from which is expressed poppy oil, used by artists. This oil is also used as a substitute for olive oil in the preparation of salads, etc.

* *Herbs with entire leaves, the uppermost whorled or opposite, sepals 3.*

Filiform stigmas 6 to many (pistil hollow)..... **Platystemon.** 1
Flat stigmas 3..... **Platystigma.** 2

* * *Herbs with divided or lobed leaves.*

Slightly lobed stigma, style distinct; sepals 2..... **Meconopsis.** 3
Filiform stigmas unequal; sepals united to form a conical cap..... **Eschscholtzia.** 4
Entire plant bristly with prickles; sepals 3, each with a horn..... **Argemone.** 1a

* * * *Shrub with entire leaves.*

Buds globular; stigmas 2..... **Dendromecon.** 5

1a. ARGEMONE, L.

Sepals 2 or 3, spinosely beaked. Petals 4 or 6. Stamens numerous, with linear anthers. Leaves sinuately pinnatifid, prickly toothed.

1. **A. hispida**, Gr. (Chicalote). Erect, armed with rigid bristles and prickles; leaves 3 to 6 inches long; flowers, nearly white, 2 to 4 inches in diameter; capsule $1\frac{1}{2}$ inches long.

1. PLATYSTEMON, Benth. CREAM-CUPS.

Sepals 3. Petals 6. Stamens many, with flattened filaments and linear anthers. Torulose carpels at first united; stigmas free.

1. **P. Californicus**, Benth. Slender, branching, 6 to 12 inches high; villous, with spreading hairs; leaves 2 to 4 inches long, sessile or clasping, broadly linear, obtuse.

pale-green. Sepals hairy; petals pale-yellow, shading to orange in the center, 3 to 6 lines long.

2. PLATYSTIGMA, Benth.

Sepals 3. Petals 4 to 6. Stamens few or many, with narrow filaments. Ovary 3-angled, oblong or linear; stigmas 3, ovate to linear. Low, slender annuals, resembling *Platystemon* in habit, with pale-green, entire, opposite or verticillate leaves and long-peduncled pale-yellow or creamy-white flowers.

1. *P. lineare*, Benth. Hairy, short-stemmed; stamens many, with dilated filaments; stigmas broad; capsule ovate.

2. *P. Californicum*, Benth. & Hook. Smooth, long-stemmed; stamens few (10 to 12) with filiform filaments; stigmas narrow; capsule linear.

3. MECONOPSIS, Viguiet.

Sepals 2. Petals 4. Stamens numerous, with filiform filaments and oblong anthers. Style distinct; stigma 4-8-lobed. Seeds numerous.

1. *M. heterophylla*, Benth. Annual, smooth, slender, 1 to 2 ft. high; lower leaves long petioled, pinnately divided, the segments oval to linear and 2 to 12 lines long; upper leaves sessile; flowers scarlet to orange, the petals 2 to 12 lines long; peduncles elongated. Very variable.

4. ESCHSCHOLTZIA, Chamisso.

Sepals coherent into a narrow pointed hood, which drops off from the top shaped torus when the flower opens. Petals 4. Stamens numerous, with short filaments and long anthers. Smooth annuals, with colorless, bitter juice; finely dissected, pale-green alternate petioled leaves, and bright orange or yellow (rarely white) flowers.

1. *E. Californica*, Cham. Has stout branching stems, 1 to 1½ ft. high; flowers 2 to 4 inches in diameter, brilliant orange toward the center; capsule 2½ inches long, curved.

Var. *Douglasii*, Gr. More slender; flowers yellow.

Var. *cæspitosa*, Brewer. Scape-like peduncles; small yellow flowers.

5. DENDROMECON, Benth.

Sepals 2. Petals 4. Stamens numerous, with short filaments and linear anthers. Ovary linear; style short; stigmas 2, short and erect. The many seeded capsule dehiscent the whole length by 2 valves separating from the placental ribs. A smooth branching shrub, with alternate vertical entire thick and rigid leaves and showy yellow flowers. The only true woody plant belonging to the order.

1. *D. rigidum*, Benth. A shrub 2 to 8 ft. high, with slender branches and whitish bark; leaves ovate to linear-lanceolate, 1 to 3 inches long, very acute or mucronate, sessile or nearly so, twisted into a vertical position, margin rough or denticulate.

ORDER 5. FUMARIACEÆ.

Tender herbs with dissected compound leaves, and irregular hypogynous flowers, the parts in twos, except the 6 diadelphous stamens.

1. DICENTRA, Borkh.

Sepals 2, small and scale-like, sometimes caducous. Corolla of two pairs of petals, flattened and cordate; the outer pair the larger and sacked at the base, the tips spreading; the inner, spoon-shaped, lightly united at the apex, inclosing the anthers and stigma. Stamens in two sets, 3 before each of the outer petals, filaments slightly cohering. Style slender; stigma 2-lobed, each lobe sometimes 2-crested.

1. *D. formosa*, DC. Leaves radical, and the compound racemes of rose-colored flowers borne on naked scapes.

2. *D. chrysantha*, Hook. & Arn. The flowers in long terminal paniculate racemes on leafy stems; corolla narrow, scarcely cordate, golden yellow.

ORDER 6. CRUCIFERÆ.

Herbs with pungent watery juice. Sepals 4. Petals 4, with blade narrowed into a claw, the lamina spreading to form a cross, rarely wanting. Stamens 6, two of them inserted lower down on the receptacle and shorter than the other four. Ovary 2-celled by a thin partition, rarely 1-celled. Leaves alternate, and flowers usually in racemes without bracts.

Since a careful examination of the fruit is usually necessary for the determination of species in this difficult order, only such plants as have large flowers or remarkable fruit are here described.

§ 1. *Pod dehiscent, 2-valved.*

* *Pod elongated, compressed parallel with the partition; seeds flat.*

Petioled leaves, lobed or divided; root tuberous.....Cardamine. 1

Stem leaves sessile, entire; root perpendicular.

Flowers purple.....Arabis. 2

Flowers orange.....Cheiranthus. 3

Flowers yellowish.....Erysimum. 4

** *Pod terete; seeds globose.*

Flowers Yellow.....Brassica. 5

*** *Pod flattened contrary to the partition.*

Pod linear; flowers axillary, yellow.....Tropidocarpum. 6

Pod obcordate; flowers minute.....Capsella. 7

Pod obovate, 2-winged at the top.....Lepidium. 8

§ 2. *Pod indehiscent, 1-celled.*

Pod orbicular, winged with a thin broad margin; flowers minute... **Thysanocarpus.** 9
 Pod long, pithy; seeds large; flowers large, veiny..... **Raphanus.** 10

1. **CARDAMINE, L.**

Pod linear, with somewhat thickened margins, merely pointed or beaked above; valves flat, nerveless. Seeds in one row somewhat flattened, wingless; cotyledons flat, accumbent. Sepals equal. Petals white or pinkish.

1. **C. paucisecta**, Benth. Stems from small deep-seated tubers, erect, 8 to 18 inches high; leaves various; the upper deeply lobed or parted, the lower often simple; petals 6 to 9 lines long; pods 1 to 1½ inches long.

2. **ARABIS, L.**

Pod linear; valves 1-nerved, not strongly. Seeds in 1 or 2 rows, flattened; cotyledons accumbent. Sepals short or narrow, rarely colored. Petals with a narrow claw, white, rose-colored, or purple.

1. **A. blepharophylla**, Hook. & Arn. Stems often tufted 4 to 12 inches high; leaves strongly ciliate, sometimes sparingly sinuate-toothed, the lower obovate or broadly spatulate, the cauline oblong, sessile; petals bright purple, 6 to 9 lines long.

2. **A. Breweri**, Wat. Cespitose, canescent, with dense stellate pubescence; stems 2 to 10 inches high; petals 1 to 4 lines long, deep rose-color; sepals purplish; pods spreading or recurved.

3. **CHEIRANTHUS, L.**

Pod elongated, compressed; valves 1-nerved or carinate. Seeds in one row, flattened, not winged; cotyledons accumbent, or rarely oblique. Calyx not colored, the outer sepals strongly gibbous. Stigma with two spreading lobes.

1. **C. asper**, Cham. & Sch. Rather sparingly pubescent with appressed 2-parted hairs; stem simple erect, leafy, 1 to 3 ft. high; leaves spatulate or oblanceolate, the lower long petioled, entire or sinuate-toothed; sepals broad 4 to 6 lines long, half the length of the bright yellow or orange petals; pods 1½ to 2 inches long.

4. **ERYSIMUM, L.**

Pod 4-angled by the prominent mid-nerve of the valves, not stipitate; cotyledons incumbent or oblique. Sepals, petals and stigma like the last.

1. **E. asperum**, DC. Similar to the last; sepals narrower; petals usually creamy white to yellow.

5. **BRASSICA, L. MUSTARD.**

Pod nearly terete or somewhat 4-sided, pointed with a long conical beak. Seeds in

one row globose; cotyledons infolding the radical. Lateral sepals usually gibbous. Petals yellow.

1. *B. campestris*, L. Smooth; lower leaves pinnately divided, with a large terminal lobe; the upper leaves oblong or lanceolate, with a broad clasping base; pods 2 inches long or more.

2. *B. nigra*, Boiss. Larger; leaves all petioled; pods less than an inch long.

Not to be confounded with *Sisymbrium officinale*, Scop., which has runcinately pinnatifid leaves, small yellow flowers and closely appressed, subulate sessile pods half an inch long; or, with *S. acutangulum*, DC., similar to the last, but the pods on short pedicels, erect and over an inch long. The last are called *Hedge Mustards*.

6. TROPIDOCARPUM, Hook

Pod linear, flattened, often 1-celled by the disappearance of the narrow partition. Seeds in two rows, minute; cotyledons incumbent. A low hirsute branching annual, with pinnately divided leaves, and yellow, solitary axillary flowers.

1. *T. gracile*, Hook. Stems weak; petals $1\frac{1}{2}$ to 3 lines long, broad; pods 6 to 20 lines long, pointed at both ends.

7. CAPSELLA, Mœnch. SHEPHERD'S PURSE.

Pod obcordate, much flattened, many-seeded; cotyledons incumbent. Slender and mostly smooth annuals, with minute flowers.

1. *C. Bursa-pastoris*, Mœnch. Somewhat hirsute at base; radical leaves mostly runcinate-pinnatifid, the cauline lanceolate, clasping.

2. *C. divaricata*, Walp. Very slender; pods elliptic-oblong; is more rare.

8. LEPIDIUM, L. PEPPERGRASS.

Pod orbicular or obovate, emarginately 2-winged at the summit; the cells 1-seeded. Low herbs, with pinnatifid or toothed leaves, and small white flowers; the petals in some species wanting, and the stamens only 2 or 4.

1. *L. latipes*, Hook. Stems stout, simple 1 to 3 inches high, surpassed by the irregularly and coarsely pinnatifid leaves; racemes capitate, in fruit an inch long or less; sepals very unequal; pod strongly reticulated, the acute wings nearly as long.

2. *L. oxycarpum*, Torr. & Gr. Stems simple or branched 3 to 6 inches high; smooth; raceme lax, elongated; pod smooth, rounded, nodding, the broad acute teeth short and divergent; petals none.

3. *L. nitidum*, Nutt. Similar to the last, but larger; petals present; pods smooth and shining, acutely margined.

4. *L. Menziesii*, DC. Hispid; petals none; pods not margined, except by the very short teeth at the summit.

Var. (?) *strictum*, Wat. Sepals green, persistent; fruiting racemes crowded cylindric-capitate, the pedicels erect, low and spreading. This plant seems to be a separate species. It has been found in San Francisco, by *Miss Annie Hughes*.

9. THYSANOCARPUS, Hook.

Pod 1-celled, 1-seeded, plano-convex, mostly pendulous on slender pedicels. Flowers minute, white or rose-colored.

1. *T. curvipes*, Hook. Six inches to two feet high; the upper leaves clasping by a broad auricled base; pods densely tomentose or smooth, 2 to 4 lines in diameter, the wing entire or crenate, veined and often perforate, emarginate at the top and tipped with the purple style. The perforate-wing form called *Lace-pod*.

2. *T. laciniatus*, Nutt. Smaller and more slender; the cauline leaves scarcely auricled at the base; pods obovate, cuneate at the base, 2 to 3 lines long.

Var. *crenatus*, Brewer. The broader wing deeply crenate or fringed. *Fringe-pod*.

3. *T. radians*, Benth. Pods round, 4 to 5 lines in diameter, scarcely emarginate, with a broad entire translucent wing conspicuously marked by radiating nerves.

4. *T. pusillus*, Hook. May be known by its minute pods hirsute with hooked hairs.

10. RAPHANUS, L. RADISH.

Coarse introduced annuals.

1. *R. sativus*, L., has a pointed 2-seeded pod.

2. *R. Raphanistrum*, L., has a necklace-shaped pod, long beaked, 1-9-seeded.

ORDER 7. CISTACEÆ.

Flowers perfect and regular. Sepals 5, persistent; and two of them smaller, wholly exterior, and bract-like. Petals 5, usually ephemeral. Stamens indefinite, with filiform filaments; anthers short. Style one. Capsule 3-valved.

1. HELIANTHEMUM, Tourn.

Petals broad. Stamens numerous (about 20). Style short; stigma 3-lobed. Low branching herbs, or somewhat woody; flowers yellow, opening only once, in sunshine.

1. *H. scoparium*, Nutt. Much branched, hairy or smooth, about a foot high; leaves narrow, 4 to 12 lines long, alternate; flowers on slender pedicels, one or several terminating the branches; petals 4 lines long.

ORDER 8. VIOLACEÆ.

Herbs distinguished by the irregular one-spurred corolla of 5 petals, 5 stamens, adnate introrse anthers conniving over the pistil, which has a club-shaped style with a one sided

stigma, a one celled ovary, forming a capsule, which splits at maturity into three parts
 Represented only by the familiar genus

1. VIOLA, L.

Sepals unequal, auricled at the base. Petals unequal, lower one spurred. Anthers nearly sessile, often coherent, the connectives of the two lower bearing spurs which are inclosed by the spur of the petal. (See ADDENDA.)

* *Leaves undivided.*

+ *Flowers not yellow, or orange.*

1. *V. canina*, L., var. *adunca*, Gr. Flowers violet or purple. Low stems sending out runners; leaves ovate, often somewhat cordate at the base, obscurely crenate; stipules foliaceous, narrowly lanceolate, lacerately toothed; spur as long as the sepals, curved; lateral petals bearded.

Var. *longipes*, Wat. The obtuse spur straight.

2. *V. ocellata*, Torr. & Gr. Stems nearly erect, 6 to 12 inches high; leaves cordate to cordate-ovate, acutish, conspicuously crenate; stipules small, scarious; upper petals white within, purple-brown without, the others pale-yellow veined with purple.

++ *Flowers yellow, tinged with purple.*

3. *V. pedunculata*, Torr. & Gr. Stems with a decumbent or procumbent base; leaves rhombic-cordate, with truncate or abruptly cuneate base, obtuse, coarsely crenate; stipules foliaceous, narrowly lanceolate, entire or gashed; showy flowers on peduncles exceeding the leaves; petals 6 to 9 lines long, the upper tinged with brown on the outside, the others veined with deep purple; lateral petals bearded; capsule smooth.

4. *V. aurea*, Kellogg. Leaves ovate to lanceolate, cuneate or sometimes truncate at base, obtuse, coarsely crenate; stipules foliaceous, lanceolate, laciniate; peduncle but little longer than the leaves; petals 4 to 6 lines long, as in the last, but lighter yellow; capsule pubescent.

5. *V. Nuttallii*, Pursh. Leaves oblong-ovate to oblong, attenuate into a long petiole, entire, or obscurely sinuate; stipules entire; peduncles usually shorter than the leaves.

+++ *Flowers yellow.*

6. *V. sarmentosa*, Dougl. Leaves rounded-cordate, reniform, or sometimes ovate, finely crenate, usually punctate with dark dots. Flowers small.

** *Leaves divided or lobed; flowers yellow, tinged with brown-purple.*

7. *V. lobata*, Benth. Distinguished by its stout stems and large palmately 5 to 9-lobed leaves. Flowers large.

8. *V. chrysantha*, Hook. Stems short; leaves bipinnatifid, with narrow segments. Flowers large, like *V. pedunculata*, but the lateral petals are not bearded.

ORDER 9. POLYGALACEÆ.

Herbs or shrubs, with simple entire exstipulate leaves, remarkable for the papilionaceous-looking flowers. In our genus the ovary is 2-celled.

1. POLYGALA, Tourn.

Sepals 5, very unequal, the 2 lateral ones large and petal-like. Petals 3, united to each other and to the stamen-tube, the middle one hooded and often crested or beaked. Stamens 6 to 8, the filaments united below into a split sheath, adnate at the base to the petals. The 2-celled ovary forms a capsule flattened contrary to the partition, notched or retuse above.

1. *P. cucullata*, Benth. Stems slender from a woody base, 2 to 8 inches high; leaves smooth, oblong-lanceolate or ovate-elliptical, $\frac{1}{2}$ to 1 inch long, short petioled; flowers rose-color; outer sepals $2\frac{1}{2}$ lines long, rounded-saccate at the base; the wings broadly spatulate, 4 to 6 lines long.

2. *P. Californica*, Nutt. Stouter; flowers greenish white.

ORDER 10. CARYOPHYLLACEÆ.

Herbs with regular and mostly perfect flowers, persistent calyx, its parts and the petals 4 or 5 and imbricated or the latter sometimes convolute in the bud, the distinct stamens commonly twice as many as the petals, ovary 1-celled with a free central placenta. Stems usually swollen at the nodes. Leaves opposite, often united at the base by a transverse line, in one group with interposed scarious stipules. Styles 2 to 5, mostly distinct. Fruit a capsule opening by valves, or by teeth at the summit. Flowers terminal, or in the forks, or in cymes.

Many species in this order are difficult to determine.

* *Sepals united into a 4-5-toothed calyx. Petals long-clawed.*

Petals with bifid appendages **Silene. 1**

* * *Sepals distinct; petals without claws.*

Petals bifid; capsule cylindric..... **Cerastium. 2**

Petals bifid capsule globose..... **Stellaria. 3**

Petals entire; capsule globose..... **Arenaria. 4**

Stipules present; styles 5..... **Spargula. 5**

Stipules present; styles 3..... **Lepigonum. 6**

1. SILENE, L.

Calyx tubular, cylindrical to campanulate, 5-toothed, 10-nerved. Petals 5, with nar-

row claws; the blade mostly bifid or many-cleft and usually crowned with 2 scales at the base. Stamens 10; styles 3, erect. Capsule dehiscent by 6, rarely 3 teeth.

1. *S. Gallica*, L. Hairy; leaves spatulate, 1 to 1½ inches long; calyx oblong-cylindric, becoming expanded by the growth of the ovoid capsule; flowers small, rose-colored, in one-sided close racemes; petals entire, slightly twisted.

2. *S. Californica*, Durand. Glandular-pubescent; stems 6 inches to 3 ft. high, lax, leafy; flowers large, deep scarlet, few at the ends of the branches; calyx 7 to 10 lines long; petals deeply parted with bifid segments, the lobes 2-3-toothed or entire, with often a lateral one.

3. *S. Douglasii*, Hook. Stems simple few-flowered; leaves narrowly oblanceolate to linear, an inch or two long; calyx oblong-cylindric, often inflated, 5 to 7 lines long; petals rose-color or nearly white; 8 to 10 lines long, bifid with broad obtuse lobes; claw broadly auricled; capsule oblong-ovate, long stiped.

2. CERASTIUM, L. MOUSE-EAR CHICKWEED.

Sepals 5. Petals 5, emarginate or bifid. Stamens 10. Styles 5, rarely less. The curved capsule dehiscing by twice as many teeth as there are styles. Flowers white.

1. *C. pilosum*, Ledeb. Erect, rather stout, more or less densely pilose; leaves oblong-lanceolate, ½ to an inch or more long, acute, almost sheathing at the base; flowers from ½ to 1 inch in diameter.

C. ARVENSE, L., has downy acute leaves.

C. VULGATUM, L., has ovate or obovate obtuse leaves; flowers clustered.

3. STELLARIA, L. CHICKWEED.

Sepals 5, rarely 4. Petals as many, 2-cleft. Stamens 10, or fewer by abortion. Low herbs with minute white flowers and 4-angled stems.

1. *S. media*, L. Weak and spreading, rooting at the lower joints; the ovate leaves less than an inch long on hairy petioles, or the upper ones sessile; stamens 3 to 10.

Introduced from Europe.

2. *S. nitens*, Nutt., has small sessile lanceolate leaves and narrow shining sepals surpassing the minute petals.

3. *S. littoralis*, Torr., is rather a stout hairy plant, with ovate leaves; flowers in a terminal cyme. May be found on the sea-shore.

4. ARENARIA, L. SANDWORT.

Distinguished chiefly from *Stellaria* by the entire petals and usually by the tufted stems and subulate rigid leaves. In our species the 3 valves of the capsule are entire; bracts foliaceous.

1. *A. Douglasii*, Torr. & Gr. Slender, much branched, 3 to 6 inches high; leaves

filiform, 3 to 12 lines long; flowers on long slender pedicels; sepals 3-nerved; petals obovate, 2 lines long or more; longer than the sepals.

2. **A. Californica**, Brew. Leaves lanceolate, 1 or 2 lines long; flowers smaller than the last; petals spatulate.

3. **A. palustris**, Wat. Stems weak, 4 to 8 inches high; leaves linear, flaccid, 6 to 12 lines long; flowers few on long pedicels; petals 3 or 4 lines long. In swamps.

5. SPERGULA, L. CORN-SPURRY.

Sepals 5. Petals 5, entire. Stamens 10, rarely 5. Ovary 1-celled, many-ovuled; styles 5, alternate with the sepals. Annuals dichotomously branched, with awl-shaped apparently whorled leaves (fascicled).

1. **S. arvensis**, L. The almost filiform leaves 1 or 2 inches long; flowers white, the long pedicels at length reflexed. Naturalized.

6. LEPIGONUM, Fries. SAND-SPURRY.

Sepals 5. Petals 5, entire, rarely fewer. Stamens 10, or fewer by abortion. Ovary 1-celled, many ovuled; styles 3, or rarely 5. Low herbs, with setaceous or linear fascicled leaves; flowers white or pink, pediceled.

1. **L. macrothecum**, Fisch. & Mey. Rather stout, often a foot high; leaves fleshy $\frac{1}{2}$ to 2 inches long, with large ovate stipules; pedicels becoming reflexed; sepals 3 or more lines long, equaling the pinkish petals. In salt-marshes.

2. **L. medium**, Fries. More slender than the last, with smaller flowers on shorter pedicels.

ORDER 11. PORTULACACEÆ.

Succulent herbs, with simple and entire leaves, and regular but unsymmetrical perfect flowers; the sepals only 2, the petals 2 to 5 or more; the stamens opposite the petals when of the same number; the ovary 1-celled. Stamens sometimes indefinitely numerous, commonly adhering to the base of the petals, these sometimes united at the base. Style 2 to 8-cleft. Stipules none.

* *Sepals 2, distinct, persistent.*

Stamens more than 5.....	Calandrinia.	1
Stamens 5.....	Claytonia.	2
* * <i>Sepals 4 to 8</i>	Lewisia.	3

1. CALANDRINIA, HBK.

Petals mostly 5 (3 to 10). Stamens 5 to 15. Ovary free, many-ovuled; style 3-cleft, short. Capsule globose or ovoid, 3-valved. Seeds shining-black. Low succulent herbs with alternate leaves.

1. **C. Menziesii**, Hook. Smooth, branching from the base, the stems ascending; leaves linear to oblanceolate, 1 to 3 inches long, the lower on slender petioles; sepals keeled, the calyx 4-angled in the bud; petals broadly obovate, red to purple, 2 to 6 lines long. One of the most abundant of open ground early flowers.

2. CLAYTONIA, L.

Petals 5, equal. Stamens 5. Style 3-cleft. Capsule and seeds as in *Calandrinia*. Radical leaves numerous; cauline perfoliate, or a pair.

1. **C. perfoliata**, Donn. Stems 2 to 12 inches high; radical leaves long-petioled, broadly rhomboidal, or deltoid, or deltoid-cordate, $\frac{1}{2}$ to 3 inches broad, obtuse; the cauline pair usually united to form an almost orbicular perfoliate leaf, concave above; the lax raceme of small pinkish flowers nearly sessile in the leaf-cup.

Var. **parviflora**, Torr. Radical leaves linear, or linear-spatulate.

Var. **spathulata**, Torr. Radical leaves linear; the cauline pair distinct or partly united on one side, ovate to lanceolate. Low and slender.

Var. **exigua**, Torr. Low, radical leaves narrowly linear or filiform; the cauline distinct, linear.

2. **C. Siberica**, L. Stems 6 to 15 inches high; radical leaves lanceolate to rhombic-ovate or nearly orbicular, long-petioled; the cauline pair ovate or varying from lanceolate to spatulate-obovate, sessile, distinct; raceme loose; the rose-colored or white petals 2 to 4 lines long.

3. LEWISIA, Pursh.

Petals 8 to 16, large and showy, rose-colored. Stamens numerous (40 or more). Style 3 to 8-parted nearly to the base. Low acaulescent fleshy perennials, with fusiform roots, and short 1-flowered scapes.

1. **L. rediviva**, Pursh. Leaves densely clustered, linear-oblong, subterete, 1 or 2 inches long, smooth and glaucous; scape jointed in the middle, bearing on the joint 5 to 7 subulate verticillate bracts; petals sometimes white, 8 to 16 lines long.

ORDER 12. HYPERICACEÆ.

Herbs or shrubs, with opposite entire punctate leaves, no stipules and perfect flowers with 4 or 5 petals and numerous stamens, the fruit a septicidal many-seeded capsule. Calyx of 4 or 5 persistent sepals. Filaments mostly in 3 sets. Styles 2 to 5, usually distinct.

1. HYPERICUM, L. ST. JOHN'S-WORT.

Sepals and petals 5. The numerous stamens in three bundles. Ovary 1 to 3-celled, the ovules growing on the parietal placenta. Flowers cymose, yellow.

1. *H. Scouleri*. Hook. Stems erect from a running rootstock $\frac{1}{2}$ to 2 feet high, terete, simple or sparingly branched; leaves ovate to oblong, clasping, an inch or less long; petals punctate, 3 to 5 lines long; capsule 3-celled.

2. *H. concinnum*, Benth. Stems from a woody base, 3 to 6 inches high; leaves from oblong to linear, acute, an inch long or less, not clasping, usually folded.

3. *H. anagalloides*, Cham & Schlecht. Stems numerous, weak, rooting at the lower joints, 1 to 10 inches long; leaves broadly ovate or elliptical, 2 to 6 inches long, obtuse, clasping; sepals exceeding the petals; capsule 1-celled.

ORDER 13. MALVACEÆ.

Herbs or shrubs with alternate stipulate leaves; distinguished by the valvate calyx, convolute petals, their bases or short claws united with the base of a column of many united stamens, these with reniform anthers. Calyx 5-cleft or parted, persistent, with sometimes a calyx-like involucl of bracts. Petals 5, usually withering without falling off. Pistil usually either a ring of ovaries around a projecting receptacle or a 3-10-celled ovary; styles united at least at the base. Leaves usually palmately ribbed. Flowers axillary. (See ADDENDA.)

1. LAVATERA, L. TREE MALLOW.

Involucl 3 to 6-cleft. Staminal column divided into numerous filaments. Styles filiform. Fruit depressed; the several carpels separating from the prominent axis, 1-seeded.

1. *L. assurgentiflora*, Kellogg. A shrub 6 to 15 ft. high; flowers 1 to 4 in the axils on drooping pedicels; petals rose-purple, 1 to $1\frac{1}{2}$ inches long, with a broad truncate limb and narrow claws having a pair of dense hairy tufts at the base. Commonly cultivated, but a native (?) of this State.

2. MALVA, L. MALLOW.

Involucl 3-leaved. Petals obcordate, small. Herbaceous. Otherwise as *Lavatera*.

M. borealis, Wallman. Annual; leaves round-cordate, crenate, 5-7-lobed; peduncles short; petals pinkish-white, 2 or 3 lines long.

Distinguished from the biennial *M. rotundifolia* by its short peduncles, small flowers and rugose carpels.

3. SIDALCEA, Gr.

Involucl none. Staminal column double; the filaments of the outer series usually united into 5 sets, opposite the petals. Flowers in a terminal raceme or spike. Herbs.

**Perennial*.

1. *S. malvæflora*, Gr. Perennial, 1 to 3 ft. high; leaves on elongated petioles,

orbicular to semi-circular in outline; the lower toothed or cleft, the upper more narrowly and deeply, 5 to 9-lobed or parted; the segments sparingly toothed, often linear and entire; flowers in naked elongated racemes; bractlets small, lanceolate; pedicels short, naked; calyx often tomentose; petals emarginate, 6 to 12 lines long, purple; carpels smooth.

2. *S. humilis*, Gr. Much resembling the last, but lower, and often decumbent at the base; leaves smaller; flowers fewer and more scattered; calyx larger, 3 to 6 lines long; carpels reticulated and pubescent.

* * *Annual.*

3. *S. diploscypha*, Gr. Pubescent with long spreading hairs, 1 to 2 ft. high; leaves deeply 5-9-cleft with lobed segments; bractlets conspicuous, 5 to 7-parted, hispid; flowers nearly sessile in close 3 to 5-flowered clusters; petals 6 to 12 lines long, broad and emarginate.

4. *S. malachroides*, Gr. Stout, hirsute, 3 to 6 ft. high, tufted; leaves large; flowers small, white or purplish, nearly sessile in close terminal heads on the short leafy branches; petals narrowly obcordate; sets of stamens indistinct.

ORDER 14. LINACEÆ.

A small order represented and characterized by the one genus

1. LINUM, L. FLAX.

Parts of the flower 5, except sometimes in the pistil. Filaments united at the base with commonly alternating teeth. Styles 5, or sometimes only 2 or 3, distinct or united. Stigmas capitate or oblong; ovary globose. Seeds twice as many as the styles. Herbs with sessile entire leaves without stipules, and cymose or panicked flowers.

§ 1. *Styles 5. Flowers blue.*

1. *L. perenne*, L. Smooth, 1 to 2½ ft. high, branching above, leafy; leaves linear to linear-lanceolate, 3 to 18 lines long, acute; stipular glands none; flowers on slender pedicels, scattered, large.

§ 2. *Styles 3; petals appendaged at base, with a tooth on each side and a third adnate to the inner face of the claw.*

* *Flowers yellow; pedicels short.*

2. *L. Breweri*, Gr. Smooth, slender, 3 to 8 inches high or more, few flowered at the summit; leaves linear-setaceous, 6 to 8 lines long; stipular glands conspicuous; petals 3 or more lines long.

* * *Flowers rose-purple to white.*

3. *L. congestum*, Gr. Nearly smooth, excepting the calyx, about a foot high;

stipular glands very small; flowers in close terminal clusters; petals about 3 lines long; capsule globose.

4. **L. Californicum**, Gr. Smooth, glaucous, 6 to 18 inches high; stipular glands conspicuous; flowers in small cymes or the lower solitary; petals 4 lines long, capsule acute, shorter than the calyx.

5. **S. spergulinum**, Gr. Smooth, 6 to 15 inches high; leaves without stipular glands; pedicels 3 to 6 lines long, and mostly solitary; sepals slightly glandular, minute; capsule obtuse, exceeding the calyx slightly.

ORDER 15. GERANIACEÆ.

Flowers perfect on axillary peduncles, regular (in our species) and symmetrical, the parts in fives. Stamens mostly in two sets, those alternate with the petals sometimes sterile. Ovary deeply 5-lobed, with a prolonged axis, or 5-celled.

§ 1. *Carpels 5, one-seeded, separating at maturity from the long central axis; the styles forming long twisted tails.*

Fertile stamens 10; tails of the carpels not bearded..... **Geranium.** 1

Fertile stamens 5; tails of the carpels bearded..... **Erodium.** 2

§ 2. *Carpels 5, one-seeded, fleshy, distinct*..... **Limnanthes.** 3

§ 3. *Carpels combined into a 5-celled ovary*..... **Oxalis.** 4

1. GERANIUM, L. CRANESBILL.

Stamens 10 with anthers, a gland behind the base of each of the shorter 5; filaments bearded at the base. Ovary 5-lobed; style 5-lobed at the top; the roundish-oblong carpels splitting away from the persistent beaked axis. Leaves palmately lobed and mostly opposite, scarious stipules; swollen-jointed stems.

1. **G. Carolinianum**, L. Diffusely branched, pubescent; leaves 1 to 2½ inches in diameter, palmately 5-7-parted, the divisions cleft into linear lobes; petals rose-colored equalling the awned sepals, 2 or 3 lines long; carpels hairy; tails half an inch long.

G. incisum, Nutt., with large purple flowers, grows in the Sierra Nevada, and in Humboldt County.

2. ERODIUM, L'Her.

Characters as in the last; but the filaments dilated, the 5 opposite to the petals sterile and scale-like; carpels attenuate to a sharp bearded base; the tails long bearded on the inner side. Leaves commonly pinnate and bipinnately parted or lobed; peduncles umbellately 2-several-flowered with a 4-bracted involucre at the base of the pedicels; flowers small.

1. **E. cicutarium**, L'Her. (FILARIA OR PIN-CLOVER.) Hairy, much branched,

decumbent; leaves pinnate the leaflets laciniately pinnatifid with narrow acute lobes, the opposite leaves unequal; the long peduncles in the axils of the smaller leaves bearing 4 to 8-flowered umbels; the slender pedicels at length reflexed, the fruit still erect; the bearded carpels with spirally twisted tails.

2. *E. moschatum*, L'Her. (MUSKY FILARIA.) Similar to the last but of a lighter green and the leaflets unequally and doubly serrate, not pinnatifid. Gives out a musky odor when wilted.

3. *E. macrophyllum*, Hook. & Arn. Leaves reniform-cordate, 1 to 3 inches broad; sepals broad, 5 to 6 lines long.

3. LIMNANTHES, R. Br.

Glands 5, alternating with the petals. Stamens 10. Style 5-cleft at the apex. Annual low diffuse herbs, with pungent juice, growing in wet places; leaves pinnate, without stipules; flowers yellowish-white or rose-colored, solitary on axillary peduncles.

1. *L. Douglasii*, R. Br. Glabrous, yellowish green, weak and succulent stems; leaflets incisely lobed; peduncles at length 2 to 4 inches long; sepals lanceolate, 3 to 4 lines long, half the length of the oblong or obovate, emarginate or truncate petals.

Var *alba*, Hartweg. Villous sepals; shorter, white petals.

4. OXALIS, L.

The parts of the flower in fives. Stamens 10; the filaments dilated and united below. Capsule columnar or ovoid, beaked with the short style. Low herbs with sour watery juice; leaves alternate or radical, digitately trifoliate, leaflets obcordate.

1. *O. Oregana*, Nutt. (REDWOOD SORREL.) Acaulescent, rusty-villous; rootstock creeping; leaflets broadly obcordate, 1 to 1½ inches broad; petioles 2 to 8 inches long; scapes equaling or exceeding the leaves, mostly 1-flowered; petals 6 to 12 lines long, white or rose-colored, often veined with purple.

2. *O. corniculata*, L. (YELLOW SORREL.) Distinguished by its slender branching stems, and smaller yellow flowers.

ORDER 16. RUTACEÆ.

Pellucid or glandular-dotted aromatic leaves, along with definite hypogynous stamens and definite seeds characterize this order, although some of the orange-tribe have many stamens.

1. PTELEA, L. HOP-TREE.

Flowers polygamous. Sepals, petals and stamens 4 or 5; ovary with a short, thick

stipe, 2-celled; style short; fruit a broadly winged orbicular samara, 2-seeded. Flowers small, greenish-white, in terminal cymes or compound corymbs.

1. *P. angustifolia*, Benth. A shrub 5 to 25 ft. high, with chestnut colored punctate bark; leaves 3-foliolate.

ORDER 17. CELASTRACEÆ.

Sufficiently characterized by the genus

1. EUONYMUS, Tourn.

Sepals and petals 4 or 5, widely spreading; Stamens as many very short on an angled disk; ovary immersed in the disk, 3-5-valved, colored, often warty. Fruit a red aril. Shrubs, with 4-angled branches, opposite petioled exstipulate serrate smooth leaves, and flowers in loose cymes on axillary peduncles.

1. *E. occidentalis*, Nutt. 7 to 15 ft. high; leaves ovate to oblong-lanceolate, acuminate, serrulate, 2 to 4 inches long; peduncles 1-4-flowered; flowers dark reddish-brown, 4 to 6 lines in diameter, the parts in fives.

ORDER 18. RHAMNACEÆ.

Shrubs or small trees, with simple undivided leaves, small and often caducous stipules, and small regular flowers, the stamens borne on the calyx and alternate with its lobes; ovary 2 to 4-celled. Flowers often apetalous; a conspicuous disk adnate to the short tube of the calyx; petals often clawed; style or stigma 2-4-lobed; fruit berry-like or dry, containing 2 to 4 seed-like nutlets.

Calyx and disk free from the ovary; filaments short; fruit berry-like. *Rhamnus*. 1
Calyx and disk adherent to the ovary; filaments long; fruit dry. *Ceanothus*. 2

1. RHAMNUS, L.

Small greenish flowers; calyx 4-5-cleft, with erect or spreading lobes, the campanulate tube persistent; petals 4 or 5 or none, on the margin of the disk; claws short; stamens 4 or 5; leaves evergreen.

§ 1. *Flowers dioecious, apetalous, solitary or fascicled in the axils.*

1. *R. crocea*, Nutt. Much branched, 3 to 15 ft. high; leaves coriaceous, oblong or obovate to obicular, 3 to 18 lines long, acutely denticulate, usually yellowish brown or copper-colored beneath; fruit red.

§ 2. *Flowers mostly perfect in pedunculate cymes.*

2. *R. Californica*, Esch. Spreading 4 to 18 ft. high; leaves ovate-oblong to ellip-

tical, 1 to 4 inches long, denticulate or nearly entire; petals very small, broadly ovate, emarginate; fruit blackish-purple.

2. CEANOTHUS, L.

Calyx 5-cleft; the lobes acute; disk thick adhering to the tube and to the ovary; petals on long claws, hooded; stamens 5; filaments long-exserted; ovary 3-lobed; style short, 3-cleft. The small flowers are in showy thyrsoid or cymose clusters. Species difficult.

§ 1. *Leaves 3-nerved.*

1. *C. thyrsiflorus*, Esch. (CALIFORNIA LILAC.) Smooth, 6 to 15 ft. high; branches strongly angled; leaves rather thick, oblong to oblong-ovate, 1 to 1½ inches long, usually smooth and shining above, canescent beneath; flowers bright blue in dense compound racemes, terminating the long and somewhat leafy peduncles.

2. *C. integerrimus*, Hook & Arn. Slender, 2 or 3 ft. high; branches round, usually warty; leaves thin, bright green, ovate to ovate-oblong, 1 to 3 inches long; thyrses large, white-flowered.

3. *C. dentatus*, Torr & Gr. Low, not rigid; leaves small glandular-serrate, fascicled, the margin strongly undulate or revolute, somewhat resinous; flowers blue, in small roundish clusters.

4. *C. sorediatus*, Hook & Arn. Rigid; inflorescence pubescent; leaves silky on the nerves, ½ to 1½ inches long; flowers blue in shortly peduncled simple racemes ½ to 2 inches long.

5. *C. divaricatus*, Nutt. Grayish, usually spinose; leaves small, not tomentose beneath; flowers light blue or white, in nearly simple often elongated racemes, 1 to 4 inches long; fruit resinous.

6. *C. incanus*, Torr & Gr. Spinose; leaves hoary beneath with a very minute tomentum, cuneate to cordate at base; flowers in short racemes, white; fruit resinously warty. A straggling shrub along creeks.

§ 2. *Leaves pinnately veined.*

7. *C. papillosus*, Torr. & Gr. More or less hispidly villous or tomentose, 4 to 6 ft. high; leaves glandular-serrulate, and the upper surface glandular-papillose, narrowly oblong, 1 to 2 inches long on slender petioles; flowers blue, in close clusters or short racemes, terminating slender naked peduncles; fruit not resinous.

§ 3. *Leaves small, often opposite, very thick, with numerous straight lateral veins; stipules mostly large and warty; flowers in sessile or shortly peduncled axillary clusters; fruit larger, with 3 horn-like or warty prominences below the summit.*

8. *C. crassifolius*, Torr. Erect 4 to 12 ft. high, the young branches white with a villous tomentum; leaves somewhat spinosely-toothed or rarely entire and revolutely margined; flowers light blue or white, in dense clusters.

9. *C. cuneatus*, Nutt. Similar to the last, but less tomentose; leaves cuneate-obovate or oblong, retuse above, on slender petioles; flowers in looser clusters.

10. *C. rigidus*, Nutt. Erect, 5 ft. high, the branchlets tomentose; leaves 2 to 5 lines long, cuneate-oblong or broadly obovate, few toothed above, very shortly petioled; flowers bright blue.

ORDER **VITACEÆ** has but one representative; the well-known California wild grape, *Vitis Californica*, Benth., which is common on the woody banks of streams.

ORDER 19. SAPINDACEÆ.

Trees or shrubs, mostly with compound or lobed leaves, with unsymmetrical or irregular flowers; the order best characterized under its suborders.

Under the order proper belongs

1. *ÆSCULUS*, L. BUCKEYE.

Leaves opposite, palmately 4-7-foliolate. Calyx tubular, unequally 5-toothed. Petals 4 or 5, unequal, with claws. Stamens 5 to 7, exserted and often unequal. Ovary 3-celled; style long. Fruit a large leathery 3-valved pod.

1. *Æ. Californica*, Nutt. Leaflets, usually 5, smooth, oblong-lanceolate, acute, obtuse at base, slenderly petiolulate, serrulate, 3 to 5 inches long; flowers in a close finely pubescent thyse which is 6 to 12 inches long; calyx 2-lobed, the lobes scarcely toothed; petals white or pale rose, half an inch long or more; stamens 5 to 7; anthers orange colored. Fruit pear-shaped, $1\frac{1}{2}$ to 2 inches long, containing, usually, one seed.

SUB-ORDER. ACERINEÆ.

Flowers polygamous or dioecious, regular, often apetalous. Ovary 2-lobed and 2-celled, each 1-seeded cell producing a wing. Leaves opposite without stipules.

2. *ACER*, Tourn. MAPLE.

Leaves palmately lobed. Calyx colored. Petals, usually 5. Stamens 3 to 12 inserted with the petals on a lobed disk. Styles 2. Fruit divaricately 2-winged.

1. *A. macrophyllum*, Pursh. (LARGE-LEAFED MAPLE.) A tree 2 or 3 feet in diameter; leaves 6 to 10 inches in diameter, deeply 3-5-cleft; flowers fragrant, yellow, in crowded pendulous racemes; fruit densely hairy; the smooth wings $1\frac{1}{2}$ inches long.

2. *A. circinatum*, Pursh. (VINE-MAPLE.) A shrub or small tree; leaves 3 to 5 inches broad, 7-9-lobed, lobes sharply serrate; flowers in corymbs loosely 10-20-flowered, on slender 2-leaved branchlets; sepals red or purple, exceeding the greenish petals; fruit smooth.

3. NEGUNDO, Mœench. BOX-ELDER.

Flowers dioecious. Calyx minute. Petals and disk none. Stamens 4 or 5. Ovary and fruit as in *Acer*. Trees; leaves pinnate; sterile flowers on clustered capillary pedicels, the fertile in drooping racemes.

1. *N. Californicum*, Torr. & Gr. Usually a small tree; leaves 3-foliolate, villous; leaflets ovate or oblong, acute, 3 or 4 inches long, the terminal largest and 3-5-lobed or coarsely serrate, the lateral ones coarsely serrate; fruit pubescent; wings slightly spreading.

In the figure *a* represents the fruit of *Acer macrophyllum*, *b* the wider spreading samara of *Acer circinatum*, and *c* the closer wings of *Negundo Californicum*. The first has hairy carpels; the second is smooth, and the last slightly hairy.

ORDER ANACARDIACEÆ is represented by the well-known Poison Oak or *Rhus diversiloba*, a slender, sometimes climbing, shrub, resembling the eastern *Rhus toxicodendron*, which is also often called Poison Oak, but is more commonly known as Poison Ivy. The eastern Sumac belongs to the same genus. There are three other species of *Rhus* in the State. The Pepper tree (*Schinus molle*), so commonly cultivated as an ornamental shade tree, belongs to this order.

ORDER 20. LEGUMINOSÆ.

The single and simple free pistil becoming a legume in fruit, the alternate leaves with stipules, and in our genera, the papilionaceous corolla with 10 stamens, mark this order, one of the largest and most important in the vegetable kingdom.

Flowers irregular. Calyx 3-5-cleft or toothed, persistent. Corolla of 5 petals, the upper larger and always external, covering the lateral pair in the bud, and these covering the lower pair, which are more or less united, forming a keel which encloses the stamens and pistil. Filaments 10, rarely 5, commonly united around the pistil, either all united or nine and the upper one free. Ovary forming a pod with a single row of seeds attached to one side; style usually inflexed or curved. In *Cercis* the upper petal is small and enclosed by the wings. In *Amorpha* there is but one petal.

Suborder Cæsalpineæ is marked by the upper petal enclosed, and distinct stamens.

Suborder Mimoseæ has regular flowers and usually many conspicuous stamens.

A

B

Fig. A. On the left is *Hosackia subpinnata*, showing a full grown pod and a flower as seen from above. On the right is a pod and flowers of *Hosackia Purshiana*. At *a* is a single flower with its bract as seen from the front. The lower leaves and bracts are larger.

Fig. B. A head of *Trifolium fucatum*, with all but three of the flowers removed, showing the common receptacle and the involucre.

Fig. C. An axillary spike of *Astragalus didymocarpus*, with ripe fruit. Below is one of the pods magnified.

C

This order is remarkable for the number of useful and beautiful plants which belong to it. Pease, beans, lentils, peanuts, clover, alfalfa, etc., furnish food for man and domestic animals. Tropical plants of this order supply, among others, the following articles of commerce: Gum arabic, gum senegal, gum copal, dragon's-blood, indigo, logwood, brazilwood, rosewood, tamarind. Many species have medical value, as senna, catchu, copaiba, etc.

There are over 6,000 species of leguminous plants, mostly tropical. About 350 species are natives of the United States, more than half of which are found in California. Only 4 or 5 species are common to this coast and the Atlantic States, and these have forms peculiar to each coast. Our 180 species are grouped under 14 genera, while the 150 species of the East (*i. e.*, the Mississippi States and eastward to the Atlantic), represent 50 genera. There are about 40 species of lupine, and the same number belonging to the genus *Astragalus*, growing within the limits of this State. Only two kinds of the former and 4 of the latter grow east of the Mississippi. The latter is the largest American genus of the

Fig. A. At *a* is seen a single flower of *Lupinus Douglasii*; *b*, the same with the upper and side petals removed, showing the united pair of long-clawed, lower petals and the base of the staminal tube.

Fig. B. *a*. The same flower with all the petals removed, showing the united stamens, 5 of which have shed the pollen and crinkled down. *b*. The stamens as they appear in a bud. The shorter stamens of the bud become the longer stamens of the flower. *c*. Anther of a long stamen in *a* magnified. *d*. Anther of a long stamen in *b* (short in *a*) magnified.

order, the species within the United States numbering about 150, nearly all of which belong west of the Rocky Mountains. We have about 25 kinds of clover; only 3 or 4 species are natives of the East. *Hosackia*, numbering 28 species in our whole country, 25 of which grow here, is not represented in the East at all. On the other hand, the large genus *Desmodium*, numbering in the East 19 species, has no representative west of the Rocky Mountains. *Pickeringia* is probably not found beyond the boundary of California. The great Australian genus *Acacia*, numbering there nearly 300 species, is represented in Southern California by a small tree (*A. Greggii*), and in the East by an herb. Possibly 30 species are cultivated for shade trees. Honey Mesquit, or Algaroba (*Prosopis juliflora*) and Screw-pod Mesquit, or Tornilla (*P. pubescens*), are small trees of Southern California. *Prosopis* and *Acacia* belong to the Suborder Mimoseæ. All the plants here described (except *Cercis*) belong to the Suborder Papilionaceæ, which is distinguished by flowers, like those of the pea, as before described.

Cercis, which, by mistake, is not described in the proper place, belongs to the Suborder Cæsalpineæ, in which the side petals enclose the upper one and the stamens are free.

§ 1. *Stamens distinct.*

Leaves digitately 3-foliolate. Herbs; yellow flowers.....	<i>Thermopsis</i> .	1
Shrub; purple flowers.....	<i>Pickeringia</i> .	2
Leaves unequally pinnate; shrubby; 1 petal.....	<i>Amorpha</i> .	9

§ 2. *Stamens all united into a sheath.*

Anthers of two forms; leaves digitate, more than three leaflets.....	<i>Lupinus</i> .	3
Anthers all alike; leaves pinnately 3-foliolate.....	<i>Psoralea</i> .	8

§ 3. *Stamens diadelphous (2 sets, 2 and 1).*

* *Leaves 3-foliolate; pods small.*

Flowers capitate. Corolla persistent.....	<i>Trifolium</i> .	4
Flowers in axillary racemes or spikes. Pod globular, wrinkled.....	<i>Melilotus</i> .	5
Flowers in axillary spikes. Pod one-seeded.....	<i>Psoralea</i> .	8
Pod spirally coiled or reniform.....	<i>Medicago</i> .	6

* * *Leaves unequally pinnate; leaflets entire; no tendrils.*

Flowers umbellate or solitary, axillary.....	<i>Hosackia</i> .	7
Flowers white or pinkish. Pod short, prickly.....	<i>Glycyrrhiza</i> .	10
Pods mostly inflated or nearly 2-celled.....	<i>Astragalus</i> .	11

* * * *Leaves terminated by a tendril or bristle or an imperfect leaflet.*

Style filiform, hairy around the apex.....	<i>Vicia</i> .	12
Style flattened dorsally toward the apex, hairy on the inner side, usually twisted half round.....	<i>Lathyrus</i> .	13

1. THERMOPSIS, R. Br.

Calyx companulate, cleft to the middle. Standard roundish, shorter than the oblong wings, the sides reflexed; keel nearly straight, its petals somewhat united, equalling the wings. Perennial herbs with the aspect of Lupine; leaflets entire; stipules foliaceous; flowers large in long terminal racemes, with persistent bracts.

1. *T. Californica*, Wat. Woolly-tomentose; stipules lanceolate; leaflets obovate to oblanceolate, an inch or two long; bracts ovate; pod hairy.

2. PICKERINGIA, Nutt.

Calyx campanulate, turbinate at the base, repandly 4-toothed. Petals equal; standard orbicular, the sides reflexed; wings oblong; keel petals oblong, distinct, straight, obtuse. A low stout much branched spinose shrub; leaves evergreen, small, nearly sessile, 1-3-foliate, without stipules; flowers large, solitary, axillary, nearly sessile.

1. *P. montana*, Nutt. Spreading, densely branched, 4 to 7 ft. high, silky-tomentose or smooth; leaflets 3 to 9 lines long; flowers from light cinnamon-red to purple, 7 to 9 lines long; stamens persistent.

3. LUPINUS, L. LUPINE.

Calyx deeply bilabiate, bibracteolate. Standard broad, the sides reflexed; wings united at the ends, enclosing the incurved beaked keel. Stipules adnate to the petioles; leaflets entire. Flowers in terminal racemes, verticillate or scattered, bracteate.

A large and difficult genus.

* *Annuals.*

Ovules 2; bracts persistent; flowers in whorls; leaves long petioled, approximate; stout. Long-villous; flowers mostly purple.....*L. microcarpus*. 15
Smoother; flowers yellow to white.....*L. densiflorus*. 16

Ovules several; bracts deciduous; flowers in whorls; petioles 1 to 3 times the length of the leaflets.

Puberulent; leaflets broad, smoother above; bracts short.....*L. affinis*. 8

Villous; leaflets narrow, both sides pubescent.

Bracts elongated; flowers rather large..... *L. nanus*. 9

Bracts short; flowers small, narrow..... *L. micranthus*. 10

Ovules several; bracts somewhat persistent; flowers scattered; petioles 1 to 4 times the length of the leaflets.

Slender; leaflets smooth above; bracts long..... *L. leptophyllus*. 11

Slender; leaflets linear; bracts short..... *L. sparsiflorus*. 12

Stout; leaflets truncate; bracts short..... *L. truncatus*. 13

Stouter; leaflets broad; bracts short; very hispid..... *L. hirsutissimus*. 14

* * *Perennials; herbaceous, tall; flowers large; ovules 8 to 12.*

Stout; long petioles; leaflets 10 to 16, very large..... *L. polyphyllus*. 4

Stout; short petioles; leaflets 7 to 10, large..... *L. rivularis*. 5

Slender, decumbent; short petioles; leaflets small.... *L. littoralis*. 6

Stoutish, erect; short petioles; keel narrow, falcate..... *L. albicaulis*. 7

* * * *Perennials; shrubby, leafy, silky-pubescent.*

Leaflets narrowly lanceolate; flowers yellow..... *L. arboreus*. 1

Densely silky-pubescent; flowers blue to white..... *L. Chamissonis*. 2

Pubescence short, tomentose; shrubby at the base..... *L. Douglasii*. 3

1. *L. arboreus*, Sims. Often 4 to 8 ft. high; sulphur-yellow, fragrant flowers, verticillate in a loose raceme; pods large, pubescent, 10-12-seeded.

2. *L. Chamissonis*, Esch. Less shrubby, 1 to 4 ft. high; leaflets 7 to 9, cuneate obovate, a half to an inch long, very silky on both sides; bracts lanceolate, shorter than the calyx; flowers sub-verticillate, blue, violet, rarely white. A variety about San Francisco with long bracts.

3. *L. Douglasii*, Agardh. Slightly woody at base; pubescence short, tomentose or silky; leaflets 7 to 9, oblanceolate to cuneate-oblong, 1 to 1½ inches long, pubescent on both sides; bracts linear-setaceous, exceeding the calyx; flowers, blue or purple; calyx with long setaceous bractlets.

4. *L. polyphyllus*, Lindl. Stout, erect, 2 to 5 ft. high, sparingly villous; stipules large, triangular to subulate; leaves distant, long petioled; leaflets 2 to 6 inches long; racemes a foot or two long; flowers mostly scattered on long pedicels, blue, purple or white; bracts oblanceolate, equaling or shorter than the calyx; keel naked.

5. *L. rivularis*, Dougl. Stout, erect, 2 to 6 ft. high, nearly smooth; stipules subulate or setaceous; leaflets 7 to 10, about equaling the petioles, ½ to 5 inches long; raceme often 1 to 2 ft. long; bracts setaceous, exceeding the calyx; flowers purple or rarely white; keel slightly ciliate.

6. *L. littoralis*, Dougl. Stems slender decumbent or ascending, 1 or 2 ft. long; leaflets a half to an inch long, at least half as long as the petioles; flowers blue or violet, with some yellow, in short racemes; keel ciliate; calyx large, with small bractlets.

7. *albicaulis*, Dougl. Distinguished by its flowers; which are light-blue to white, the standard strongly reflexed, the margins cohering near the apex, naked, acute; the narrow keel very strongly falcate.

8. *L. affinis*, Agardh. Stem a foot high; leaflets broadly wedge-obovate, emarginate or obtuse, an inch long or more; the petioles twice longer; petals 5 lines long; the keel usually naked; bracts short.

9. *L. nanus*, Dougl. Slender stem 6 inches to a foot high, villous, often branching from the base; leaflets linear to oblanceolate, half to an inch long, the petioles 1 to 3 times longer; bracts exceeding the calyx; petals very broad, 5 to 6 lines long, bluish-purple, or at first nearly white; the standard shorter and usually marked with purple lines.

10. *L. micranthus*, Dougl. Similar to the last, but the flowers smaller, in usually shorter more dense racemes; bracts shorter than the calyx; petals 2 to 3 lines long, narrow.

Var. *microphyllus*, Wat. The lower and more hirsute form, with leaflets but 3 to 6 lines long.

Var. *bicolor*, Wat. Flowers larger, more like *L. Nanus*.

Var. *trifidus*, Wat. Very hairy; lower lip of the calyx 3-parted.

11. *L. leptophyllus*, Benth. Rarely branched, 1 or 2 ft. high, villous; leaflets narrowly linear on slender petioles; smooth above; bracts setaceous, much exceeding the calyx; petals 5 or 6 lines long, bluish-lilac, with a deep crimson spot upon the standard.

12. *L. sparsiflorus*, Benth. Very slender, sparingly branched, 1 to 1½ ft. high, villous, with spreading hairs; upper leaves very small; leaflets 5 to 9, linear, ¼ to 1 inch long; petals violet, 5 lines long, the standard shorter; pod half an inch long.

13. *L. truncatus*, Nutt. Stout, branched, 1 to 2 ft. high; leaflets linear, narrowed from the truncate or somewhat 3-toothed apex to the base, smooth above, ¾ to 1½ inches long, nearly equaling the petiole; petals deep-purple, 4 or 5 lines long, the standard shorter; pod about an inch long.

Here belongs *L. STIVERI*, Kellogg. A beautiful species of the Sierra Nevada, with yellow standard and rose-colored wings.

14. *L. hirsutissimus*, Benth. A foot high or more, very hispid, with spreading straight and viscid stinging hairs; leaflets broadly cuneate-obovate, obtuse or retuse, rarely acute, mucronulate; flowers in loose racemes, reddish-purple, large.

15. *L. microcarpus*, Sims. Villous, with long hairs, 6 to 18 inches high; leaves approximate on long petioles; leaflets usually 9, cuneate-oblong, obtuse or emarginate, smooth above, 1 to 2 inches long; calyx densely villous, large; petals purple to white, 6 or 7 lines long; the hairy 1-2-seeded pods 8 lines long.

16. *L. densiflorus*, Benth. Much resembling the last; calyx smooth or finely pubescent; petals yellow or ochroleucous, rarely white or pink.

L. luteolus, Kellogg, may be found, distinguished by its more slender habit, smaller and fewer leaflets, and bracts exceeding the calyx.

4. TRIFOLIUM, L. CLOVER.

Calyx 5 cleft with nearly equal teeth, persistent. Corolla withering, persistent; wings narrow, keel short obtuse. Stamens usually diadelphous. Style filiform. Pod small and usually inclosed in the calyx, membranaceous, indehiscent or dehiscent at the ventral suture, 1 to 6-seeded. Herbs with leaves palmately 3 or rarely 5-7-foliolate; stipules adnate to the petiole; flowers in capitate racemes, spikes or umbels, rarely few or solitary; peduncles axillary or only apparently terminal.

All our species annual.

§ 1. *Heads not involucre; ovules 2.*

* *Heads apparently terminal; flowers sessile, not reflexed; calyx teeth plumose, filiform.*

1. **T. Macræi**, Hook. & Arn. Somewhat villous, erect, 6 to 12 inches high; stipules ovate to lanceolate; leaflets obovate to narrowly oblong, obtuse or retuse, serrulate, about half an inch long; flowers dark purple, 3 lines long, in dense ovate long peduncled heads; calyx very villous; the straight teeth as long as the petals, often tinged with purple; pod 1-seeded.

Var. **dichotomum**, Brew. A taller and stouter form, with larger flowers in heads nearly an inch long; corolla more conspicuous, tipped with white.

* * *Heads axillary, small; flowers on short pedicels, at length reflexed; calyx teeth subulate; mostly smooth.*

2. **T. ciliatum**, Nutt. Erect, often 1 to 2 ft. high; leaflets similar to the last; corolla white or purplish, little exerted, 3 lines long; calyx tube campanulate; the lanceolate teeth very acute, rigid, the scarious margin rigidly ciliate.

3. **T. gracilentum**, Torr. & Gr. Erect, slender, a foot high or less; stipules lanceolate; leaflets cuneate oblong to ovate or obcordate, retuse, about half an inch long, serrulate; flowers pale rose-color or purplish on pedicels a line long or less; calyx campanulate, the subulate teeth nearly equaling the corolla.

4. **bifidum**, Gr. Exactly like the last, but the leaflets narrow, the sides sparingly toothed or entire, and all deeply notched or cleft at the apex.

§ 2. *Heads subtended by an involucre; peduncles axillary; flowers sessile, not reflexed.*

* *Involucre not membranaceous, deeply lobed, and the lobes laciniately and sharply toothed; corolla not becoming inflated.*

5. **T. involucreatum**, Willd. Smooth; stems ascending, often a span high or more; leaflets mostly oblanceolate and acute at each end, a half to an inch long; flowers half an inch long, in close heads, purple or rose-colored; the narrow calyx teeth all entire; ovules mostly 5 or 6.

Var. **heterodon**, Wat. Heads larger and leaflets broader; some of the calyx teeth setaceously cleft.

6. **tridentatum**, Lindl. Smooth or glandular-puberulent, slender and usually erect,

a half to two feet high; leaflets linear to narrowly lanceolate, sharply serrate; heads rather large, the flowers 6 to 8 lines long, purple, often tipped with white; calyx strongly nerved; the rigid teeth usually shorter than the tube, abruptly narrowed into the spinulose apex, often with a stout tooth on each side; ovules usually 2.

Var. *obtusiflorum*, Wat. Stouter and often glandular-puberulent, with broader leaflets and larger flowers; calyx teeth entire.

7. *T. pauciflorum*, Nutt. Smooth, very slender; stems ascending or decumbent; leaflets obovate to oblanceolate or sometimes linear, half an inch long or less, serrulate; heads few flowered; involucre small; flowers 3 or 4 lines long, not much exceeding the calyx; deep purple to light rose-colored; calyx teeth subulate, entire; pod 2-seeded.

* * *Involucre membranaceous, at least at the base, less deeply lobed; corolla not inflated.*

8. *T. microcephalum*, Pursh. Villous, with soft hairs, slender, erect or decumbent; stems often a foot or two long; leaflets oblanceolate to obovate, usually retuse, serrulate; heads small, dense; involucre about 9-lobed, the lobes acuminate 3-nerved, entire; calyx hairy, nearly equaling the white or light rose-colored corolla; ovules 2; pod 1-seeded.

9. *T. microdon*, Hook & Arn. Resembling the last; involucre broader, nearly inclosing the head; its lobes about 3-toothed; calyx smooth.

* * * *Standard becoming conspicuously inflated and inclosing the rest of the flower; involucre nearly obsolete in No. 12.*

10. *T. barbigerum*, Torr. Somewhat pubescent; stems rather stout, decumbent or ascending, a span high or less; stipules scarious; involucre as broad as the heads, shortly lobed; calyx-tube short, membranaceous; its teeth setaceously awned, plumose, the lower usually exceeding the purple corolla, sometimes 3-parted; pod 2-seeded.

Var. *Andrewsii*, Gr. A stout villous form, the heads sometimes an inch broad; calyx teeth very long.

11. *T. fucatum*, Lindl. Smooth; stems stout and succulent, a foot or two high; stipules large and scarious, usually very broad and entire; leaflets obovate, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long; heads large; involucre broad, deeply cleft; flowers often an inch long, pale rose-colored or purplish; 2-6-seeded.

12. *T. depauperatum*, Desv. Smooth, low, slender; heads only 3-10-flowered; involucre scarcely more than a scarious ring.

13. *T. amplexans*, Torr & Gr. Like the last; the involucre larger. Probably only a variety.

5. MELILOTUS, Tourn. SWEET CLOVER.

Flowers as in *Trifolium*, except that the petals are free from the stamens and deciduous. Pod 2-seeded.

1. *M. parviflora*, Desf. Annual, smooth, erect, often 2 or 3 ft. high; leaflets

mostly cuneate, oblong, obtuse, denticulate, an inch long or less; flowers yellow, a line long, in slender axillary pedunculate racemes; pedicels a line long.

6. MEDICAGO, L.

Characters nearly as the last; style subulate; pod compressed, falcate, incurved or spirally coiled.

1. *M. sativa*, L. (LUCERN, ALFALFA.) Stems erect, 1 to 4 ft. high; from a deep perennial root, smooth; leaflets cuneate-oblong or oblanceolate, toothed above; flowers 3 or 4 lines long, racemed; pods numerous, spirally twisted, veined, smooth.

2. *M. denticulata*, Willd. BUR-CLOVER. Annual, nearly smooth, prostrate or ascending; leaflets cuneate-ovate or obcordate, toothed above; flowers small, yellow, usually 3 to 8 in an axillary cluster; pods spiral, armed with a double row of hooked prickles.

3. *M. lupulina*, L. Pubescent, procumbent; flowers very small, yellow, in short spikes; pods smooth, reniform, 1-seeded.

7. HOSACKIA. Douglas.

Calyx teeth nearly equal, usually shorter than the tube. Petals free from the stamens, nearly equal; standard ovate or roundish, the claw often remote from the others; wings obovate or oblong; keel somewhat incurved. Style incurved. Pod linear, sessile, several-seeded, partitioned between the seeds.—Herbaceous or rarely suffrutescent; leaves pinnate, 2-many-foliolate; stipules minute and gland-like, rarely scarious or foliaceous; flowers yellow or reddish, in axillary sessile or pedunculate umbels.

The flowers usually change to reddish or reddish-brown in drying. Matured pods are necessary for the determination of species.

§ 1. *Pod shortly acute, linear and many-seeded, straight, smooth; seeds suborbicular; flowers and fruit not reflexed; peduncles long; keel broad above mostly obtuse.*

Stipules large, foliaceous; villous, viscid.....*H. stipularis*. 1

Stipules scarious; smooth.

Bract small or none; wings usually white.....*H. bicolor*. 2

Bract 1-3-foliolate, at the umbel; keel and wings purplish.....*H. gracilis*. 3

Stipules reduced to blackish glands.

Appressed-pubescent; tall, stout; pod long, smooth.....*H. grandiflora*. 4

Flowers very small, solitary.....*H. parviflora*. 5

§ 2. *Pod shortly acute, 3-7-seeded, straight; flowers small, mostly solitary; keel acute; stipules gland-like; villous.*

Blade of the standard cordate; leaflets 3 to 5; nearly smooth.....*H. parviflora*. 5

Flowers peduncled; corolla scarcely exceeding the calyx; leaves nearly sessile, 1-3-foliolate.....*H. Purshiana.* 6

Flowers nearly sessile, not bracteate; corolla larger; leaves petioled, 3-5-foliolate; low. Calyx-teeth about equaling the tube, pod 5-seeded.....*H. subpinnata.* 7
Teeth much longer than the tube; pod 2-4-seeded.....*H. brachycarpa.* 8

§ 3. *Pod long-attenuate upward, incurved, pubescent; stipules gland-like; leaflets 3 to 7; seeds 1 or 2; peduncles short or none; flowers and fruit reflexed.*

Somewhat woody; nearly smooth; stems angled; leaflets mostly 3, oblong to linear. Umbels sessile; teeth narrow, erect.....*glabra.* 9
Peduncles short or nearly wanting; teeth usually recurved.....*H. cytisoides.* 10
Peduncles shorter; teeth short and blunt.....*H. juncea.* 11

Very silky-pubescent or tomentose; stems herbaceous: pod pubescent, short; umbels on short peduncles.

Very pubescent throughout; flowers 3 or 4 lines long.....*H. tomentosa.* 12
Less pubescent; stem smooth; flowers smaller.....*H. Heermanni.* 13

1. *H. stipularis*, Benth. Rather tall, stout, two feet high or more, glandular; leaflets 15 to 21, obovate oblong, acute and mucronate, a half to an inch long; stipules large ovate; often fragrant.

2. *H. bicolor*, Dougl. Smooth, erect and stout; leaflets 5 to 9, obovate or oblong, a half to an inch long; stipules rather large; peduncles longer than the leaves, 3-7-flowered, naked or sometimes with a small 1-3-foliolate bract at the summit; flowers nearly sessile yellow, the wings often white; pod slender nearly 2 inches long.

3. *H. gracilis*, Benth. Much like the last; usually low and slender, the weak stems a span high or more; umbel with a petioled 1-3-foliolate bract; flowers yellow, keel and wings purplish.

4. *H. grandiflora*, Benth. Stout, 1 to 5 ft. high, more or less appressed silky-pubescent; leaflets 5 to 7 on an elongated rachis, 6 to 9 lines long; peduncles elongated; umbel 3-8-flowered, usually subtended by a single leaflet; flowers nearly sessile, 6 to 11 lines long, yellowish or greenish white, often tinged with purple, pod slender, smooth.

5. *H. parviflora*, Benth. Smooth or nearly so, stems slender, ascending, a span high or less; leaflets 3 to 5, obovate and very small to narrowly oblong and 6 to 8 lines long; bract 1-3-foliolate; flowers about 2 lines long, yellow.

H. Purshiana, Benth. Silky-villous, rarely smooth, often a foot high or more; leaflets varying from ovate to lanceolate, 3 to 9 lines long; peduncles usually exceeding the leaves; the solitary flowers 2 or 3 lines long.

7. *H. subpinnata*, Torr. & Gr. Villous or smooth, decumbent, a span high or less; leaflets half an inch long or less; flowers 3 or 4 lines long; pod linear oblong, about 5-seeded.

8. *H. brachycarpa*, Benth. Resembling the last; softly villous; pod villous, 2-4-seeded.

9. *H. glabra*, Torr. Very nearly smooth; stems woody at base, 2 to 8 ft. long, erect or decumbent; leaflets oblong to linear-oblong, 3 to 6 lines long; umbels numerous, sessile; flowers 3 or 4 lines long; seeds 2.

10. *H. cytisoides*, Benth. Resembling the last; peduncles equaling or exceeding the leaves, or sometimes very short, usually with a 1-3-foliate bract at the top; calyx-teeth attenuate, mostly recurved.

11. *H. juncea*, Benth. Somewhat shrubby, erect; leaflets obovate to oblong, 2 to 4 lines long; umbels on very short peduncles or sessile; flowers about 3 lines long; calyx 2 lines long or less; teeth short and blunt.

12. *H. tomentosa*, Hook & Arn. Very pubescent, weak and flexuose, prostrate or ascending, a foot or more long; leaflets 5 to 7, cuneate-oblong to obovate, acute, 3 to 6 lines long; umbels on short bracteolate peduncles, or the uppermost sessile; flowers 3 or 4 lines long; calyx half as long or more, very villous.

13. *H. Heermannii*, Durand & Hilgard. Less pubescent, much branched and spreading; leaflets smaller; flowers smaller.

3. PSORALEA, L.

Calyx lobes nearly equal, or the lower one longer; the two upper often connate. Keel broad and obtuse above, united with the wings. Stamens diadelphous or monadelphous. Pod ovate, indehiscent, 1-seeded, thick, sessile. Perennial herbs punctate with dark glandular dots. Leaves pinnately 3-foliate. Stipules free.

* *Stems prostrate, creeping; leaves orbicular.*

1. *P. orbicularis*, Lindl. Petioles 6 to 12 inches long; the leaflets 2 to 4 inches across, slightly cuneate at the base; peduncles equaling or exceeding the leaves, bearing a close villous spike of large flowers; the lower tooth of the calyx much the longest and about equaling the purplish corolla; stamens diadelphous.

* * *Stems erect.*

2. *P. strobilina*, Hook & Arn. Two or three feet high; petioles 3 or 4 inches long; leaflets rhombic ovate, softly pubescent beneath, about 2 inches long; stipules large, membranaceous; flowers in short oblong spikes, smaller than the last; stamens monadelphous.

3. *P. macrostachya*, D C. Three to even twelve feet high; leaflets ovate-lanceolate, an inch or two long or more; peduncles much exceeding the leaves; spikes cylindrical, silky villous, the hairs often blackish; the lower tooth of the calyx but little the longest, scarcely equaling the purple petals; tenth stamen nearly free.

4. *P. physodes*, Dougl. A foot or two high, nearly smooth, slender; leaflets

ovate, mostly acute, about an inch long; the white or purplish flowers in short, close racemes; calyx at length inflated; stamens monadelphous.

9. AMORPHA, L.

Calyx obconical, nearly equally 5-toothed; wings and keel wanting; the standard erect, folded together. Stamens slightly united at the base, exserted. Pod 1-2-seeded. Shrubs, glandular-punctate; the unequally pinnate leaves with the leaflets stipellate; flowers purple or violet in dense clustered terminal spikes.

1. *A. Californica*, Nutt. Three to eight feet high, puberulent; leaflets 5 to 7 pairs, oblong-elliptical, obtuse, mucronulate, an inch long; spikes 1 to 6 inches long.

10. GLYCYRRHIZA, L. LIQUORICE.

Flowers nearly as in *Astragalus*. Erect perennial herbs, glandular viscid; leaves unequally pinnate; stipules deciduous; flowers in dense axillary pedunculate spikes; root large and sweet.

1. *G. lepidota*, Nutt., var. *glutinosa*, Wat. Two or three feet high; flowers yellowish white or pinkish; the short peduncles covered with stout viscid hairs. Rare; on water courses.

10. ASTRAGALUS, Tourn. RATTLE-WEED.

Calyx 5-toothed. Corolla and its slender clawed petals usually narrow; keel obtuse. Stamens diadelphous. Legume very various, commonly turgid or inflated, one or both sutures usually projecting inward, frequently so much as to divide the cell into two. Seeds few or many on slender stalks, generally small for the size of the pod. Herbs, or a few woody at the base; with unequally pinnate leaves, and small flowers, chiefly in simple spikes or racemes from the axils.

A vast genus of five or six hundred species; about fifty on the Pacific coast. The fruit is needed for the determination of the species.

* *Root annual; pod not inflated, 2-celled.*

Pod wrinkled, 2-lobed, 2-seeded.....*A. didymocarpus*. 1
Pod not wrinkled, several-seeded.....*A. tener*. 2

* * *Root perennial; pod bladdery-inflated, 1-celled.*

Stipe a little exceeding the calyx; pod with pointed ends.....*A. oxyphysus*. 3
Stipe much exceeding the calyx; pod obtuse, one-sided.....*A. leucophyllus*. 4

Stipe, none; pod large and very bladdery, many seeded; leaflets mostly in many pairs; spike or raceme many flowered.

Stipules distinct; pod rather firm walled.....*A. Crotalariae*. 5

Stipules united; pod thin.....*A. Menziesii*. 6

Stipules membranaceous; corolla yellowish.....*A. Douglasii*. 7

1. *A. didymocarpus*, Hook. & Arn. Slender from 3 inches to a foot high; leaflets 9 to 15, narrowly oblong to linear and more or less cuneate, deeply notched at the apex; small flowers white and violet; pod not over two lines long, short oval and deeply 2-lobed lengthwise.

2. *A. tener*. Gr. A span or so in height; leaflets similar to the last, not so deeply notched or entire; pod about half an inch long, 5-10-seeded; corolla 4 or 5 lines long, bright violet to pale and violet-tipped.

3. *A. oxyphysus*, Gr. Canescent with very soft silky pubescence; stem erect, 2 to 3 ft. high; leaflets oblong an inch or less in length; peduncles much exceeding the leaves; corolla greenish-white 8 lines long; bladdery pod acuminate and tapering into the recurved stipe which a little exceeds the calyx.

4. *A. leucophyllus*, Torr. & Gr. Less canescent than the last; flowers about half an inch long; corolla yellowish-white; the thin pod unequal-sided, an inch and a half long on a filiform pubescent stipe of almost equal length.

5. *A. Crotalariae*, Gr., var. *virgatus*, Gr. Smooth or the young parts villous; stems 2 or 3 ft. high, stout; stipules scarious, triangular or subulate, distinct; peduncles elongated; racemes virgate and loose, 4 to 10 inches long; the white flowers soon deflexed.

6. *A. Menziesii*, Gr. Villous with whitish hairs or soon green and almost smooth; stems sometimes decumbent, 1 to 4 ft. high; the lower stipules united opposite the leaf; inflorescence similar to the last but more dense; pod larger (an inch and a half or more long) and more bladdery.

7. *A. Douglasii*, Gr. Cinereous-puberulent, almost smooth in age, stems ascending, a foot or so in height; leaflets in numerous pairs; linear or linear-oblong, 4 to 9 lines long; spike, half to an inch long; 10-20-flowered; pod gibbous-ovoid, $1\frac{1}{2}$ to 2 inches long.

11. VICIA, Tourn. VETCH. TARE.

Calyx 5-toothed or cleft, usually unequally. Wings adherent to the middle of the short keel. Stamens diadelphous or nearly so. Style filiform, inflexed, the apex surrounded by hairs or hairy upon the back. Pod flat 2-valved, shortly stipitate. Herbs, with angular stems climbing by branched tendrils terminating the pinnate leaves; leaflets entire or toothed at the apex; stipules semi-sagittate; flowers solitary or in loose axillary racemes.

** Perennials; flowers in pedunculate racemes.*

1. *V. gigantea*, Hook. Stout and tall, climbing several feet high; leaflets 10 to 15 pairs, oblong, obtuse, mucronate, an inch or two long; stipules large; peduncles 5-18-flowered; corolla 6 or 7 lines long, pale purple; pod broadly oblong, $1\frac{1}{2}$ inches long or more, smooth 3-4-seeded.

The seeds are large and edible; blackens in drying.

2. *V. Americana*, Muhl. Usually rather stout, 1 to 4 ft. high, smooth: leaflets 4 to 8 pairs, variable, linear to ovate-oblong, truncate to acute, $\frac{1}{2}$ to 2 inches long; pedun-

cles 4-8-flowered; flowers purplish, 6 to 9 lines long; style very villous at the top; pods an inch long or more, 3-6-seeded.

Var. *truncata*, Brewer. Somewhat pubescent; leaflets truncate and often 3-5-toothed at the apex.

Var. *linearis*, Watson. Leaves all linear. Only the varieties are likely to be found.

* * *Slender annuals; flowers mostly solitary.*

3. *V. exigua*, Nutt. A span to two feet high, somewhat pubescent; leaflets about 4 pairs, linear, acute, a half to an inch long; peduncles usually short, rarely 2-flowered; flowers 3 lines long, purplish; pod about 6-seeded.

4. *V. sativa*, L. Rather stout, somewhat pubescent; leaflets 5 or 6 pairs, obovate-oblong to linear, retuse, long-mucronate; flowers nearly sessile, an inch long, violet-purple.—The common tare of Europe. Introduced.

12. LATHYRUS, L.

Style dorsally flattened toward the top, and usually twisted, hairy on the inner side. Peduncles usually equaling or exceeding the leaves and several flowered.

* *Rachis of the leaves tendril bearing; pod sessile; racemes several flowered.*

1. *L. venosus*, Muhl., var. *Californicus*, Watson. Very stout, several feet high; stems often strongly winged; leaflets oblong-ovate, acute; flowers nearly or quite an inch long, purple; pod about 2 inches long.

2. *L. vestitus*, Nutt. Slender, a foot to 6 or 10 feet high; stems not winged, stipules narrow, often small; flowers pale rose-color or violet, usually 7 to 10 lines long; ovary pubescent.

3. *L. palustris*, L. Slender, a foot or two high; stem often winged; leaflets narrowly oblong to linear, acute, an inch or two long; flowers purplish, half an inch long.

Var. *myrtifolius*, Gr. Stipules broader; leaflets ovate to oblong, shorter.

* *Rachis of the leaves not tendril bearing, or rarely so; pod shortly stipitate, peduncles long; 2-6-flowered.*

4. *L. littoralis*, Endl. Densely silky-villous throughout; stems numerous, from creeping root-stocks, stout, decumbent or ascending, $\frac{1}{2}$ to 2 ft. high; leaflets 1 to 3 pairs, with a small linear or oblong terminal one; calyx teeth nearly equal; standard bright purple, 6 to 8 lines long, exceeding the paler wings and keel; pod villous, an inch long.

ORDER 21. ROSACEÆ.

Herbs, shrubs or trees, with alternate leaves, usually evident stipules, mostly numerous stamens borne on the calyx; distinct free pistils from one to many, or in one sub-

order few and coherent with each other and adherent to the calyx forming a 2-several-celled inferior ovary.

Nearly all the cultivated fruits of the temperate zones belong to this order.

SUB-ORDER 1. AMYGDALÆ.

Carpels solitary, or rarely 5, becoming drupes, entirely free from the calyx, this or its lobes deciduous.—Trees or shrubs with bark and seeds tasting and smelling like those of the peach or cherry. Stipules few, deciduous.

Flowers perfect; carpel solitary.....	Prunus.	1
Flowers not all perfect; carpels 5.....	Nuttallia.	2

SUB-ORDER 2. ROSACEÆ PROPER.

Carpels free from the persistent calyx becoming akenes, follicles or berries.

§ 1. *Carpels few, becoming follicles; calyx open.*

Shrubs; follicles 2 to 8; flowers minute, in panicles.....	Spiræa.	3
Shrubs; follicles 1 to 5; flowers larger, in corymbs.....	Neillia.	4

§ 2. <i>Carpels several or numerous, on a spongy receptacle, forming a compound berry.....</i>	Rubus.	5
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§ 3. *Carpels one or many, becoming dry akenes.*

Shrubs; solitary, axillary apetalous flowers.....	Cercocarpus.	6
Herbs; carpels many, on a fleshy receptacle.....	Fragaria.	7

Herbs; carpels many, on a dry receptacle—

Stamens 20 to 25.....	Potentilla.	8
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Stamens 10.....	Horkelia.	9
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Shrub: heath-like, with subulate fascicled leaves.....	Adenostoma.	10
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§ 4. <i>Erect shrubs; showy flowers.....</i>	Rosa.	11
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SUB-ORDER 3. POMEÆ.

Carpels 2 to 5, inclosed in and mostly adnate to the fleshy calyx-tube, in fruit becoming a berry-like pome. Trees or shrubs, with free stipules.

Stamens 10, in pairs; fruit red.....	Heteromeles.	12
Stamens 20; fruit black.....	Amelanchier.	13

1. PRUNUS, Tourn. PLUM, CHERRY, ETC.

Calyx 5-cleft, deciduous. Petals 5, spreading. Stamens 15 to 25, inserted with the

petals. Ovary solitary, free, with two pendulous ovules; style terminal. Fruit a drupe, with usually a long stone containing one seed.

Deciduous; flowers white.

Corymbose; appearing before or with the leaves.....*P. emarginata*. 1
 Racemose; appearing after the leaves.....*P. demissa*. 2
 Evergreen; leafless racemes axillary.....*P. ilicifolia*. 3

1. *P. emarginata*, Walp. Four to eight feet high, with bark like the ordinary cherry tree, and chestnut-brown very slender branches; leaves oblong-obovate to oblanceolate, obtuse, narrowed to a short petiole; corymb 6-12-flowered, shorter than the leaves; flowers 4 to 6 lines broad; fruit globose, black; stone with a thick grooved ridge upon one side.

2. *P. demissa*, Walp. (WILD CHERRY.) Slender, 2 to 12 ft. high; leaves ovate to oblong-ovate, abruptly acuminate, mostly rounded or somewhat cordate at the base; racemes 3 or 4 inches long; fruit purplish-black or red, edible but astringent.

3. *P. ilicifolia*, Walp. (EVERGREEN CHERRY.) Much branched, 8 to 12 ft. high, with grayish-brown bark; leaves thick and rigid, shining above, broadly ovate to ovate-lanceolate, spinosely toothed; flowers small in racemes $\frac{1}{2}$ to 2 inches long; fruit red or dark purple, half an inch or more thick.

2. NUTTALLIA, Torr. & Gr. Oso BERRY.

Petals 5, broadly spatulate, erect. Stamens 15 in two rows, 10 inserted with the petals, and 5 lower down upon the disk lining the calyx-tube, filaments very short, the lower declined. Carpels 5, inserted on the persistent base of the calyx-tube, free, smooth.

1. *N. cerasiformis*, Torr. & Gr. A shrub 2 to 15 ft. high; leaves rather broadly oblanceolate, short petioled; racemes of greenish white flowers, appearing with the branchlets from the same bud; drupes blue-black; with a slight furrow on the inner side, 6 to 8 lines long, bitter.

3. SPIRÆA, L.

Calyx persistent, 5-lobed. Petals 5, rounded, nearly sessile. Stamens 20 or more, inserted with the petals. Carpels distinct and sessile, becoming several-seeded follicles.

1. *S. discolor*, Pursh. A diffuse shrub, 4 ft. high or more with grayish brown bark, pubescent; leaves broadly ovate, truncate at base or cuneate into a slender petiole, pinnately toothed or lobed, the lobes often dentate; panicle of dingy white flowers much branched, tomentose.

Var. *ariæfolia*, Wat. Taller, 5 to 15 ft. high, leaves 2 or 3 inches long, panicle larger.

Var. *dumosa*, Wat. Only 1 or 2 ft. high, leaves an inch long or less, cuneate into a short margined petiole.

4. NEILLIA, Don. NINE-BARK.

Carpels 1 to 5, inflated and divergent; flowers large, white, in simple corymbs.

1. *N. opulifolia*, Benth. & Hook. A shrub 3 to 10 ft. high, with slender spreading or recurved branches and ash-colored shreddy bark; leaves ovate to cordate, 3-lobed and toothed, 1 to 3 inches long.

5. RUBUS, L.

Calyx persistent 5-lobed. Petals 5, conspicuous. Stamens numerous. Carpels numerous, on a convex receptacle, becoming small globose 1-seeded drupes, forming a compound berry.—Fruit edible.

§ 1. *Fruit with a bloom, separating from the receptacle when ripe.*

Leaves simple, palmately lobed; stem soft, woody.....*Nutkanus*. 1

Leaves 3-foliate, or on the flowering branches simple, rarely 5-foliate; stems soft, woody, prickly—

Flowers large, red.....*spectabilis*. 2

Flowers white.....*leucodermis*. 3

Stems herbaceous, trailing unarmed.....*pedatus*. 4

§ 2. *Fruit persistent, black and shining; stems prickly, flowers white*.....*ursinus*. 5

1. *R. Nutkanus*, Moc. (THIMBLE-BERRY.) Stems erect, 3 to 8 ft. high; older bark shreddy, no prickles; leaves 4 to 12 inches broad; flowers large white, rarely rose-colored, an inch or more across; fruit red, large.

2. *R. spectabilis*, Pursh. (SALMON-BERRY.) Stems 5 to 10 ft. high, similar to the last, but armed with a few prickles. Distinguished by its large red flowers and cylindrical-ovoid yellow or purplish berries.

Var. *Menziesii*, Wat. Densely tomentose and silky.

3. *R. leucodermis*, Dougl. (RASPBERRY.) May be known by its leaflets, white, tomentose beneath, prickly stem, white flowers, and its yellowish red white-bloomed fruit.

4. *R. pedatus*, Smith. Stems slender pubescent; leaflets cuneate-obovate, an inch or less in length; flowers white; the at length reflexed sepals exceeding the petals; berry of only 3 to 6 large red pulpy drupelets.

5. *R. ursinus*, Cham. & Schl. (BLACKBERRY.) Stems weak or trailing, 5 to 20 ft. long; fruit oblong.

6. CERCOCARPUS, HBK.

Calyx narrow, tubular, the campanulate 5-lobed limb deciduous. Petals none. Stamens in 2 or 3 rows on the limb of the calyx. Carpels solitary. Fruit a villous akene, included in the enlarged calyx-tube, tailed with the elongated exserted plumose twisted style.

Evergreen shrubs or trees. *C. ledifolius*, Nutt. is the MOUNTAIN MAHOGANY of the Sierra Nevada. The following is found in the Coast Range.

1. **C. parvifolius**, Nutt. A shrub 2 to 10 ft. high, or rarely a tree, branching from a thick base. Tails of the fruit often 4 inches long.

7. FRAGARIA. Tourn. STRAWBERRY.

Calyx persistent; limb 5-toothed, with 5 alternate bractlets. Petals white, spreading. Stamens in one row. Carpels numerous, smooth; styles lateral short. Receptacle much enlarged in fruit, conical, scarlet, bearing the small akenes on its surface.

1. **F. Chilensis**, Ehrh. Densely villous, with silky hairs; leaflets thick, smooth above; flowers often an inch broad; fruit ovate; akenes deeply pitted.

2. **F. Californica**, Cham. & Schl. Somewhat villous; leaves thin, veiny; fruit small; akenes not in pits.

8. POTENTILLA, L.

Calyx as in *Fragaria*. Petals yellow, rarely white. Stamens 20 to 50, marginal in 1 to 3 rows. Carpels numerous. Akenes small, on a dry receptacle.

1. **P. glandulosa**, Lindl. Perennial, erect, a foot or more high; leaves pinnate; leaflets 5 to 9, rounded, ovate, coarsely serrate; flowers cymose; calyx 4 to 6 lines long, usually villous, with coarse hairs; bractlets shorter than the lobes; petals not exceeding the calyx; stamens 25 in one row.

2. **P. Anserina**, L. (SILVER-WEED.) White tomentose and silky-villous leaves, all radical, often a foot long or more; leaflets 3 to 10 pairs, with smaller ones interposed, oblong, sharply serrate, tomentose, at least beneath; flowers yellow, solitary, on scape-like peduncles.

9. HORKELIA, Cham. & Schl.

Petals obovate to linear, often clawed, white or pink. Stamens 10, in two rows; filaments more or less dilated; those opposite to the sepals broadest. Flowers cymose.

* *Bractlets nearly as broad as the calyx-lobes.*

1. **H. Californica**, Cham. & Schl. Glandular-pubescent; stems a foot high or more; leaflets 5 to 10 pairs, 3 to 8 lines long; calyx about equaling the spatulate petals.

Var. **sericea**, Gr. Canescent throughout, with a dense, silky pubescence; leaflets larger.

* * *Bractlets much narrower than the calyx-lobes.*

2. **H. tenuiloba**, Gr. Canescently villous, a foot high; leaflets 8 to 12 pairs, deeply incised, 2 or 3 lines long.

3. **H. Bolanderi**, Gr. Densely hoary-pubescent, cespitose, the stems 3 or 4 inches high, the numerous leaflets minute, with rounded lobes.

10. ADENOSTOMA, Hook & Arn. CHAMISO.

Calyx persistent, 5-lobed; tube obconical, 10-ribbed; lobes membranaceous, broad.

Petals 5, orbicular, spreading. Stamens 10 to 15, usually 2 or 3 together between the petals. Fruit a membranaceous akene, included in the indurated calyx-tube.—Evergreen shrubs, somewhat resinous; flowers small, white, in terminal, racemose panicles.

1. *A. fasciculatum*, Hook & Arn. A diffusely branching shrub, 2 to 20 ft. high, with reddish virgate branches and grayish shreddy bark; leaves fascicled, linear subulate, 2 to 4 lines long, usually channeled on one side, smooth.

Alchemilla arvensis, Scop., belongs here. Its minute, greenish, apetalous flowers are fascicled in the axils of the small leaves and inclosed by the cleft stipules. A small under herb, growing on sandy hillsides.

Acæna trifida, R. & Pav. Is another apetalous herb, with silky, villous leaves and stem rising from a woody caudex; 3 to 15 inches high. The leaves are pinnate, the leaflets pinnately cleft into 3 to 7 segments. The greenish flowers with purple stamens are in a crowded terminal spike. Habitat similar to the last.

11. ROSA. Tourn. ROSE.

It is not necessary to here characterize this well-known genus.

1. *R. Californica*, Cham. & Schl. Erect, 2 to 8 ft. high, sparingly armed with usually recurved prickles, tomentose; leaflets 2 or 3 pairs; calyx lobes tomentose, often glandular leafy; petals 6 to 9 lines long; fruit globose.

2. *R. gymnocarpa*, Nutt. Slender, 1 to 4 ft. high, armed with straight slender prickles or unarmed, smooth; leaflets 2 to 4 pairs, glandular; flowers solitary, rarely 2 or 3, rarely an inch in diameter; calyx lobes at length deciduous; fruit small, ovate or pear-shaped.

12. HETEROMELES, J. Römer. PHOTINIA.

Calyx 5-parted. Petals 5, spreading. Stamens in pairs, opposite the calyx-teeth. Fruit red, berry-like.—An evergreen shrub or small tree, with coriaceous, simple, sharply serrate leaves. Flowers white in terminal panicles.

1. *H. arbutifolia*, Röm. Leaves dark green above, lighter beneath, narrowly to oblong lanceolate, acute at each end, 2 to 4 inches long, on short petioles, slightly revolute margins; fruit 2 or 3 lines in diameter.

Pirus rivularis, Dougl., the *Oregon Crab-Apple*, may be found in Sonoma County.

13. AMELANCHIER, Med. SERVICE-BERRY.

Calyx-tube campanulate; the limb 5-parted, persistent. Petals 5, oblong, ascending. Stamens 20, short. Carpels 3 to 5 inferior, becoming membranaceous and partially 2-celled; styles united below or distinct. Fruit berry like, globose.—Shrubs or small trees; leaves simple, serrate; flowers white, racemose; fruit purplish, edible.

1. *A. alnifolia*, Nutt. A shrub 3 to 8 ft. high; leaves broadly ovate, sometimes corlate at the base, serrate only toward the summit, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long.

ORDER CALYCANTHACEÆ, is represented by *Calycanthus occidentalis*, Hook. & Arn., an erect shrub 6 to 12 ft. high, with opposite entire lanceolate leaves, 3 to 6 inches long and large solitary livid or purplish red flowers; sepals and petals numerous, linear-spatulate. The common name of the Eastern species—*Sweet-Scented Shrub*—is scarcely applicable to our species.

ORDER 22. SAXIFRAGACEÆ.

Herbs, shrubs, or small trees, distinguished from *Rosaceæ* by albuminous seeds; usually by definite stamens, not more than twice the number of the calyx-lobes; commonly by the want of stipules; sometimes by the leaves being opposite; and in most by the partial or complete union of the 2 to 5 carpels into a compound ovary. Seeds usually indefinite or numerous. Petals and stamens on the calyx. Styles inclined to be distinct. Only the *Hydrangieæ* have many stamens.

Tribe 1. SAXIFRAGÆ. Herbs, leaves mostly alternate and without distinct stipules. Styles or tips of the carpels distinct. Fruit capsular or follicular.

* *Ovary with 2 or rarely more cells, or of as many distinct carpels.*

Stamens 10, rarely more.....	Saxifraga.	1
Stamens 5.....	Boykinia.	1

* * *Ovary 1-celled.*

Stamens 10, included.....	Tellima.	3
Stamens 10, exserted.....	Tiarella.	4
Stamens 5, and styles 2.....	Heuchera.	5

Tribe 2. HYDRANGIÆ. Shrubs, leaves opposite, simple, no stipules. Fruit capsular.

A tall shrub. Large white flowers.....	Philadelphus.	6
Low, scarcely shrubby. Small flowers.....	Whipplea.	7

Tribe 3. GROSSULARIÆ. Shrubs, leaves alternate with stipules adnate to the petiole or wanting. Fruit a berry.

Calyx-tube adnate to the ovary.....	Ribes.	8
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1. SAXIFRAGA, L. SAXIFRAGE.

Calyx 5-lobed, free, or its tube coherent with the lower part of the ovary. Petals 5. Fruit of 2 follicles, or a 2-lobed capsule.—In our species stemless; flowers white.

1. *S. Virginensis*, Michx. Leaves thickish, oblong-ovate to spatulate-obovate, coarsely toothed or almost entire, an inch or two long and the margined petiole often as long; scape viscid pubescent, 4 to 12 inches high, at length loosely many flowered in a paniculate cyme; flowers, small white.

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Rattan, Volney/A popular California flor

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