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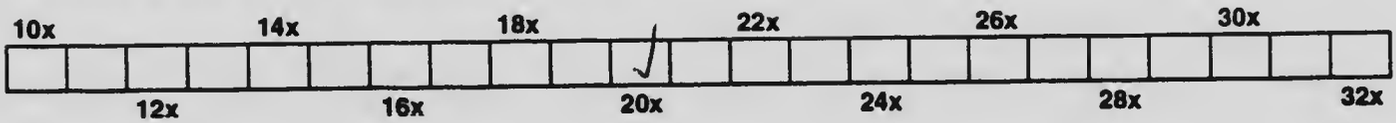

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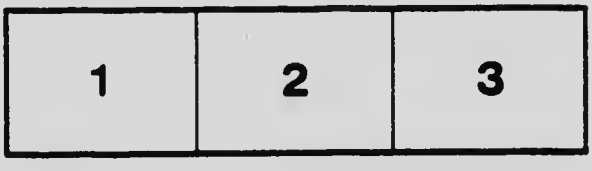

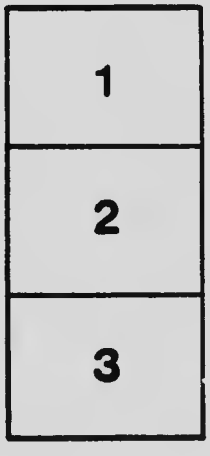

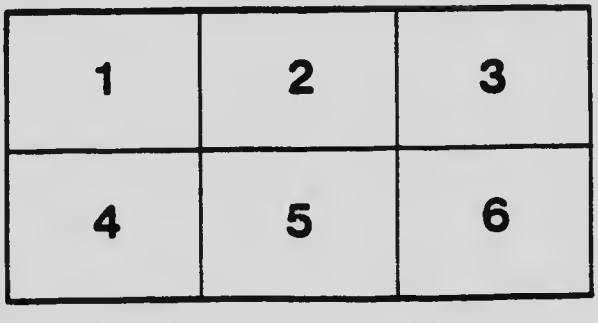

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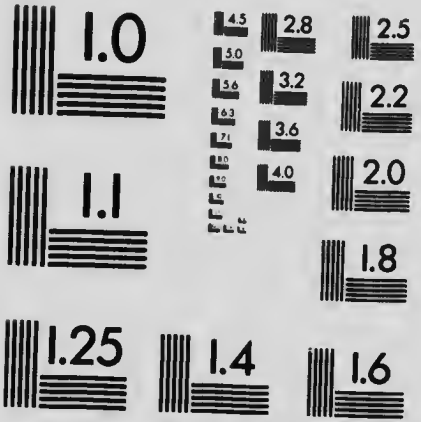

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THE ELEMENTS
OF
STRUCTURAL BOTANY

WITH SPECIAL REFERENCE TO THE STUDY
OF
CANADIAN PLANTS

BY
H. B. SPOTTON, M.A., F.L.S.,
INSPECTOR OF HIGH SCHOOLS FOR ONTARIO

THE FLORA OF PRINCE EDWARD ISLAND
BY
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PREFACE TO FIRST EDITION.

The work, of which the present little volume forms the first part, has been undertaken, at the suggestion of several eminent educationists, to supply a palpable want. The works on Botany, many of them of great excellence, which have found their way into this country, have been prepared with reference to climates differing, in some cases, very widely from our own. They consequently contain accounts of many plants which are entirely foreign to Canada, thus obstructing the search for descriptions of those which happen to be common to our own and other countries, and, on the other hand, many of our Canadian species are not mentioned at all in some of the Classifications which have been in use. It is believed that the Classification which is to form the second part of this work will be found to contain all the commonly occurring species of the Provinces whose floras it is designed to illustrate, without being burdened with those which are either extremely rare or which do not occur in Canada at all.

The present part is designed to teach the Elements of Structural Botany in accordance with a method which is believed to be more rational than that commonly adopted; and it will be found to supply all that is requisite for passing the examinations for Teachers' Certificates of all grades, as well as any others demanding an elementary knowledge of the subject. It contains familiar descriptions of common plants, illustrating the chief variations in plant-structure, with a view to laying a foundation for the intelligent study of Systematic Botany with the aid of the second part; then follow a few lessons on Morphology; and the Elements of

Vegetable Histology are treated of in as simple and brief a manner as was thought to be consistent with the nature of the subject.

The Schedules, the use of which is very strongly recommended, were devised by the late Professor Henslow, of Cambridge University, to fix the attention of pupils upon the salient points of structure. They will be found invaluable to the teacher as tests of the accuracy of his pupils' knowledge. The cost of striking off a few hundred blanks of each sort would be very trifling, and not worth considering in view of the resulting advantages.

The wood-cuts are from drawings from living specimens, except in two or three instances where assistance was derived from cuts of well-known excellence in standard works on Botany. It need hardly be said that the engravings are not in any sense intended to take the place of the living plants. They are designed chiefly to assist in the examination of the latter; and whilst it is hoped that they may be of service to those who may desire to read the book in the winter season, it is strongly urged upon teachers and students not to be satisfied with them as long as the plants themselves are available.

The works most frequently consulted in the preparation of the text are those of Hooker, Gray, Bentley, and Oliver.

Finally, the Author looks for indulgence at the hands of his fellow-teachers, and will be glad to receive suggestions tending to increase the usefulness of the work, and to extend a taste for what must ever be regarded as one of the most refining as well as one of the most practically useful of studies.

TABLE OF COMMON PLANTS EXAMINED

PHANEROGAMS.

Buttercup, Hepatica, Marsh-Marigold.	representing	Ranunculace.e
Shepherd's Purse..... ...	"	Cruciferæ.
Round-leaved Mallow.....	"	Malvace.e.
Garden Pea	"	Leguminos.e.
Great Willow-herb.....	"	Onagrace.e.
Sweet Brier, Strawberry, Crab-Apple, Cherry, Raspberry	"	Rosace.e.
Water-Parsnip.....	"	Umbellifer.e.
Dandelion.....	"	Composit.e.
Catnip.....	"	Labiat.e.
Cucumber.....	"	Cucurbitace.e.
Oak	"	Cupulifer.e.
Willow	"	Salicace.e.
Maple.....	"	Sapindace.e.
Dog's tooth Violet.....	"	Liliace.e.
Iris.....	"	Iridace.e.
Orchis.....	"	Orchidace.e.
Indian Turnip, Calla.....	"	Arace.e.
Timothy, Red-top, Meadow-Grass, Chess, Couch-Grass, Old-witch Grass, Barnyard Grass, Foxtail.....	"	Gramine.e.
White Pine, Ground Hemlock	"	Conifer.e.

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THE ELEMENTS

OF

STRUCTURAL BOTANY.

---

1. The study of Botany is commonly rendered unattractive to the beginner by the order in which the parts of the subject are presented to him. His patience becomes exhausted by the long interval which must necessarily elapse before he is in a position to do any practical work for himself. In accordance with the usual plan, some months are spent in committing to memory a mass of terms descriptive of the various modifications which the organs of plants undergo; and not until the student has mastered these, and perhaps been initiated into the mysteries of the fibro-vascular system, is he permitted to examine a plant as a whole. In this little work, we purpose, following the example of some recent writers, to reverse this order of things, and at the outset to put into the learner's hands some common plants, and to lead him, by his own examination of these, to a knowledge of their various organs—to cultivate, in short, not merely his memory, but also, and chiefly, his powers of observation.

It is desirable that the beginner should provide himself with a magnifying glass of moderate power for examining the more minute parts of specimens; a sharp penknife for dissecting; and a couple of fine needles, which he can himself insert in convenient handles, and which will be found of great service in separating delicate parts, and in impaling fine portions for examination with the aid of the lens.

CHAPTER I.

EXAMINATION OF A BUTTERCUP.

2. To begin with, there is no plant quite so suitable as our common Buttercup. This plant, which has conspicuous yellow flowers, may be found growing in almost every moist meadow. Having found one, take up the whole plant, loosening the soil a little, so as to obtain as much of the Root as possible. Wash away the earth adhering to the latter part, and then proceed to examine your specimen. Beginning with the **Root** (Fig. 1), the first noticeable thing is that it is not of the same colour as the rest of the plant. It is

Fig. 1

Fig. 1.—Fibrous Root of Buttercup.

nearly white. Then it is not of the same *form* as the part of the plant above ground. It is made up of a number of thread-like parts which spread out in all directions, and if you examine one of these threads through your magnifying glass, you will find that from its surface are given off many finer threads, called *rootlets*. These latter are of great importance to the plant; it is largely by means of their tender extremities, and the parts adjacent to these, that it imbibes the nutritious fluids contained in the soil.

Whilst you are looking at these delicate rootlets, you may perhaps wonder that they should be able to make their way through the soil, but how they do this will be apparent to you if you examine the tip of one of them with a microscope of considerable power. Fig. 2 represents such a tip highly magnified. It is to be observed that the growth of the rootlet does not take place at the very extremity, but immediately behind it. The extreme tip consists of harder and firmer matter than that behind, and is in fact a sort of cap or thimble to protect the growing part underneath. As the rootlets grow, this little thimble is pushed on first through the crevices of the soil, and, as you may suppose, is soon worn away on the outside, but it is as rapidly renewed by the rootlet itself on the inside.

Fig. 2.

Another difference between the root and the part above ground you will scarcely have failed to discover: the root has no leaves, nor has it any buds.

You may describe the root of the Buttercup as *fibrous*.

Fig. 2.—Extremity of rootlet; *a*, the harder tip; *b*, the growing portion behind the tip.

Fig. 3.

3. Let us now look at the **Stem** (Fig. 3). It is upright, pretty firm, coloured green, and leaves spring from it at intervals. As there is scarcely any appearance of wood in it, we may describe it as *herbaceous*. At several points along the main stem branches are given off, and you will observe that immediately below the point from which every branch springs there is a leaf on the stem. The angle between the leaf and the stem, on the upper side is called the *axil* of the leaf (*axilla*, an armpit), and it is a rule to which there are scarcely any exceptions, that branches can only spring from the axils of leaves.

The stem and all the branches of our plant terminate, at their upper extremities, either in flowers or in flower-buds.

4. Let us now consider the **Leaves**. A glance will show you that the leaves of this plant are not all alike. Those at the lower end of the stem have long stalks (Fig. 4), which we shall henceforward speak of as *petioles*. Those a little higher up have petioles too, but they are not

Fig. 3.—Stem of Buttercup.

quite so long as the lower ones, and the highest leaves have no petioles at all. They appear to be sitting on the stem, and hence are said to be *sessile*. The lowest leaves of all, as they seem to spring from the root, may be described as *radical*, whilst the higher ones may be called *cauline* (*caulis*, a stem). The broad part of a leaf is its *blade*. In the plant we are now examining, the blades of the leaves are almost divided into distinct pieces, which are called *lobes*, and each of these again more or less deeply *cut*. Both petioles and blades of our leaves are covered with minute hairs and so are said to be *hairy*.

Fig. 4.

Hold up one of these leaves to the light, and you will observe that the veins run through it in all directions, forming a sort of net-work. The leaves are therefore *net-veined*.

The points along the stem from which the leaves arise are called *nodes*, and the portions of stem between the nodes are called *internodes*.

5. Let us next examine the Flowers. Each flower in our plant is at the end either of the stem or of a branch of the stem. The upper part of the stem and its branches, upon which the flowers are raised, are called the *peduncles* of the flowers.

Take now a flower which has just opened. Beginning at the outside, you will find five little spreading leaves, somewhat yellowish

Fig. 5.

Fig. 4.—Radical leaf of Buttercup.
Fig. 5.—Flower of Buttercup, from the back.

in colour. Each of these is called a *sepal*, and the five together form the **calyx** of the flower. If you look at a flower which is a little older, you will probably not find any sepals. They will have fallen off, and for this reason they are said to be *deciduous*. So, in like manner, the leaves of most of our trees are deciduous, because they fall at the approach of winter. You will find that you can pull off the sepals one a time, without disturbing those that remain. This shows that they are not connected together. They are therefore said to be *free*, and the calyx is described as *polysepalous*.

Inside the circle of sepals there is another circle of leaves, usually five in number, bright yellow in colour, and much larger than the sepals. Each of them is called a *petal*, and the five together form the **corolla** of the flower. Observe carefully that each petal is not inserted in front of a sepal, but in front of the space between two sepals. The petals can be removed one at a time like the sepals. They, too, are free, and the corolla is *polypetalous*. If you compare the petals with one another, you will see that they are, as nearly as possible, alike in size and shape. The corolla is therefore *regular*.

6. We have now examined minutely enough for our present purpose, the calyx and corolla. Though their divisions are not coloured green, like the ordinary leaves of the plant, still, from their general form, you will have no difficulty in accepting the statement that the sepals and petals are in reality *leaves*. It will not be quite so apparent that the parts of the flower which still remain are also only modifications of the same structure. But there is good evidence that this is the case. Let us, however, examine these parts that remain. There is

first a large number of little yellow bodies, each at the top of a little thread-like stalk. Each of these bodies, with its stalk, is called a **stamen**. The little body itself is the *anther*, and the stalk is its *filament*. Your magnifying glass will show you that each anther consists of two oblong sacs, united lengthwise, the filament being a continuation of the line of union (Fig. 7).

Fig. 6.

If you look at a stamen of a flower which has been open some time, you will find that each anther-cell has split open along its outer edge, and has thus allowed a fine yellowish dust to escape from it (Fig. 8). This dust is called *pollen*. A powerful magnifier will show this pollen to consist of grains having a distinct form.

Fig. 7.

Fig. 8.

As the stamens are many in number, and free from each other, they are said to be *polyandrous*.

Fig. 9.

7. On removing the stamens there is still left a little raised mass (Fig. 9), which, with the aid of your needle, you will be able to separate into a number of distinct pieces, all exactly alike, and looking something like unripe seeds. Fig. 10 shows one of them very much magnified, and cut through lengthwise. These little bodies, taken separately, are called *carpels*. Taken together, they form the **pistil**. They are hollow, and each of them contains, as the figure shows, a

Fig. 10.

Fig. 6.—Section of a flower of Buttercup.
Fig. 7.—Stamen of Buttercup.
Fig. 8.—The same, showing longitudinal opening of the anther
Fig. 9.—Head of carpels of Buttercup.
Fig. 10.—A single carpel cut through lengthwise to show the ovule.

little grain-like substance attached to the lower end of its cavity. This substance, in its present condition, is the *ovule*, and later on becomes the *seed*.

You will notice that the carpel ends, at the top, in a little bent point, and that the convex edge is more or less rough and moist, so that in flowers whose anthers have burst open, a quantity of pollen will be found sticking there. This rough upper part of the carpel is called the *stigma*. Fig. 11 shows a stigma greatly magnified. In many plants the stigma is raised on a stalk above the ovary. Such a stalk is called a *style*. In the Buttercup the style is so short as to be almost suppressed. When the style is entirely absent, the stigma is said to be sessile. The hollow part of the carpel is the *ovary*.

Fig. 11.

In our plant the pistil is not connected in any way with the calyx, and is consequently said to be *free* or *superior*, and, as the carpels are not united together, the pistil is said to be *apocarpous*.

Fig. 12.

8. Remove now all the carpels, and there remains nothing but the swollen top of the peduncle. This swollen top is the *receptacle* of the flower. To it, in the case of the Buttercup, all four parts, calyx, corolla, stamens, and pistil, are attached. When a flower has all four of these parts it is said to be *complete*.

9. Let us now return to our statement that the structure of stamens and pistils is only a modification of leaf-structure generally. The stamen

Fig. 11.—Stigma of Buttercup with adhering pollen-grains; highly magnified.

Fig. 12.—Diagram to show leaf-structure of a stamen.

looks less like a leaf than any other part of the flower. Fig. 12 will, however, serve to show us the plan upon which the botanist considers a stamen to be formed. The anther corresponds to the leaf-blade, and the filament to the petiole. The two cells of the anther correspond to the two halves of the leaf, and the cells burst open along what answers to the margin of the leaf.

10. In the case of apocarpous pistils, as that of the Buttercup, the botanist considers each carpel to be formed by a leaf-blade doubled lengthwise until the edges meet and unite, thus forming the ovary. Fig. 13 will make this clear.

11. There are many facts which support this theory as to the nature of the different parts of the flower. Suffice it to mention here, that in the white Water-Lily, in which there are several circles of sepals and petals, it is difficult to say where the sepals end and the petals begin, on account of the gradual change from one set to the other. And not only is there a gradual transition from sepals to petals, but there is likewise a similar transition from petals to stamens, some parts occurring which are neither altogether petals, nor altogether stamens, but a mixture of both, being imperfect petals with imperfect anthers at their summits. We can thus trace ordinary leaf-forms, by gradual changes, to stamens.

Fig. 13.

We shall then distinguish the leaves of plants as *foliage-leaves* and *flower-leaves*, giving the latter name exclusively to the parts which make up the flower, and the former to the ordinary leaves which grow upon the stem and its branches.

Fig. 13.—Diagram to illustrate the leaf-structure of the carpel.

12. You are now to try and procure a Buttercup whose flowers, or some of them, have withered away, leaving only the head of carpels on the receptacle. The carpels will have swollen considerably, and will now show themselves much more distinctly than in the flower which we have been examining. This is owing to the growth of the ovules, which have now become seeds. Remove one of the carpels, and carefully cut it through the middle lengthwise. You will find that the seed almost entirely fills the cavity. (Figs. 14 and 15.)

Fig. 14.

Fig. 15.

This seed consists mainly of a hard substance called *albumen*, enclosed in a thin covering. At the lower end of the albumen is situated a very small body, which is the *embryo*. It is this which developes into a new plant when the seed germinates.

Fig. 16.

13. We have seen, then, that our plant consists of several parts:

(1). **The Root.** This penetrates the soil, avoiding the light. It is nearly white, is made up of fibres, from which numbers of much finer fibres are given off, and is entirely destitute of buds and leaves.

(2). **The Stem.** This grows upward, is coloured, bears foliage-leaves at intervals, gives off branches from the axils of these, and bears flowers at its upper end.

(3). **The Leaves.** These are of two sorts: *Foliage-leaves* and *Flower-leaves*. The former are sub-divided

Fig. 14.—Ripe carpel of Buttercup.
Fig. 15. Section of same.
Fig. 16. Section of seed showing the small embryo. All much magnified.

into *radical* and *cauline*, and the latter make up the flower, the parts of which are four in number, viz.: **calyx, corolla, stamens,** and **pistil.**

It is of great importance that you should make yourselves thoroughly familiar with the different parts of the plant, as just described, before going further, and to that end it will be desirable for you to review the present chapter carefully, giving special attention to those parts which were not perfectly plain to you on your first reading.

In the next chapter, we shall give a very brief account of the *uses* of the different parts of the flower. If found too difficult, the study of it may be deferred until further progress has been made in plant-examination.

CHAPTER II.

FUNCTIONS OF THE ORGANS OF THE FLOWER.

14. The chief use of the calyx and corolla, or *floral envelopes*, as they are collectively called, is *to protect the other parts of the flower*. They enclose the stamens and pistil in the bud, and they usually wither away and disappear shortly after the anthers have shed their pollen, that is, as we shall presently see, as soon as their services as protectors are no longer required.

15. The corollas of flowers are usually bright-coloured, and frequently sweet-scented. There is little doubt that these qualities serve to attract insects, which, in search

of honey, visit blossom after blossom, and, bringing their hairy limbs and bodies into contact with the open cells of the anthers, detach and carry away quantities of pollen, some of which is sure to be rubbed off upon the stigmas of other flowers of the same kind, subsequently visited.

16. The essential part of the stamen is the anther, and the purpose of this organ is to produce the pollen, which, as you have already learned, consists of minute *grains*, having a definite structure. These little grains are usually alike in plants of the same kind. They are furnished with two coats the inner one extremely thin, and the outer one much thicker by comparison. The interior of the pollen-grain is filled with liquid matter. When a pollen-grain falls upon the moist stigma it *begins to grow* in a curious manner (Fig. 17). The inner coat

Fig. 17.

pushes its way through the outer one, at some weak point in the latter, thus forming the beginning of a slender tube. This slowly penetrates the stigma, and then extends itself downwards through the style, until it comes to the cavity of the ovary. The liquid contents of the pollen-grain are carried down through this tube, which remains closed at its lower end, and the body of the grain on the stigma withers away.

The ovary contains an ovule, which is attached by one end to the wall of the ovary. The ovule consists of a kernel, called the *nucleus*, which is usually surrounded by two coats, through both of which there is a minute opening to the nucleus. This opening is called the *micropyle*, and is

Fig. 18.

Fig. 17.—Pollen-grain developing a tube.

Fig. 18.—Section of an ovule, showing central nucleus, coats, and micropyle.

always to be found at that end of the ovule which is not attached to the ovary. (Fig. 18, *m*.)

About the time the anthers discharge their pollen, a little cavity, called the *embryo-sac*, appears inside the nucleus, near the micropyle. The pollen-tube, with its liquid contents, enters the ovary, passes through the micropyle, penetrates the nucleus, and attaches itself to the outer surface of the embryo-sac. Presently the tube becomes empty, and then withers away, and, in the meanwhile, a minute body, which in time develops into the embryo, makes its appearance in the embryo-sac, and from that time the ovule may properly be called a seed.

17. In order that ovules may become seeds, it is always essential that they should be *fertilized* in the manner just described. If we prevent pollen from reaching the stigma —by destroying the stamens, for instance—the ovules simply shrivel up and come to nothing.

Now it is the business of the flower to produce seed, and we have seen that the production of seed depends mainly upon the stamens and the pistil. These organs may consequently be called the *essential organs* of the flower. As the calyx and corolla do not play any *direct* part in the production of seed, but only protect the essential organs, and perhaps attract insects, we can understand how it is that they, as a rule, disappear early. Their work is done when fertilization has been accomplished.

Having noticed thus briefly the part played by each set of floral organs, we shall now proceed to the examination of two other plants, with a view to comparing their structure with that of the Buttercup.

CHAPTER III.

EXAMINATION OF HEPATICA AND MARSH-MARIGOLD—RESEMBLANCES BETWEEN THEIR FLOWERS AND THAT OF BUTTERCUP.

18. **Hepatica.** You may procure specimens of the Hepatica almost anywhere in rich dry woods, but you will not find it in flower except in spring and early summer. It is very desirable that you should have the

Fig. 19.

plant itself, but for those who are unable to obtain specimens, the annexed engravings may serve as a substitute.

Fig. 19. Anemone Hepatica.

Beginning, then, at the root of our new plant, you see that it does not differ in any great measure from that of the Buttercup. It may, in like manner, be described as *fibrous*.

The next point is the stem. You will remember that in the Buttercup the stem is that part of the plant from which the leaves spring. Examining our Hepatica in the light of this fact, and following the petioles of the leaves down to their insertion, we find that they and the roots appear to spring from the same place—that there is, apparently, *no stem*. Plants of this kind are therefore called *acaulescent*, that is, *stemless*, but it must be carefully borne in mind that the absence of the stem is only apparent. In reality there is a stem, but it is so short as to be almost indistinguishable.

The leaves of the Hepatica are, of course, all *radical*. They will also be found to be *net-veined*.

19. The **Flowers** of the Hepatica are all upon long peduncles, which, like the leaves, appear to spring from the root. Naked peduncles of this kind, rising from the ground or near it, are called *scapes*. The flower-stalks of the Tulip and the Dandelion furnish other familiar examples.

Let us now proceed to examine the flower itself. Just beneath the coloured leaves there are three leaflets, which you will be almost certain to regard, at first sight, as sepals, forming a calyx. It will not be difficult, however, to convince you that this conclusion would be incorrect. If, with the aid of your needle, you turn back these leaflets, you will readily discover, between them and the coloured portion of the flower, *a very short bit of stem* (Fig. 20), the upper end of which is the *receptacle*. As these

leaflets, then, are on the peduncle, *below* the receptacle, they cannot be sepals. They are simply small foliage leaves, to which, as they are found beside the flower, the name *bracts* is given. Our flower, then, is apparently without a calyx, and in this respect is different from the Buttercup. The whole four parts of the flower not being present, it is said to be *incomplete*.

Fig. 20.

20. It may be explained here that there is an understanding among botanists, that if the calyx and corolla are not both present it is always the corolla which is wanting, and so it happens that the coloured part of the flower under consideration, though resembling a corolla, must be regarded as a calyx, and the flower itself, therefore, as *apetalous*.

21. Remove now these coloured sepals, and what is left of the flower very much resembles what was left of our Buttercup, after the removal of the calyx and corolla. The stamens are very numerous, and are inserted on the receptacle. The carpels are also numerous (Fig. 21), are inserted on the receptacle, and are free from each other (*apocarpous*). And if you examine one of the carpels (Fig. 22) you will find that it contains a single ovule. The flower, in short, so much resembles that of the Buttercup that you will be prepared to learn that the two belong to the same Order or Family of plants, and you will do well to observe and remember such resemblances as have just been brought to your notice, when you set out to examine plants for your

Fig. 21.

Fig. 22.

Fig. 20.—Flower of Hepatica, with bracts below.
Fig. 21.—Carpels of Hepatica. Fig. 22.—Single carpel, enlarged.

selves, because it is only in this way, and by slow steps, that you can acquire a satisfactory knowledge of the reasons which lie at the foundation of the classification of plants.

22. **Marsh-Marigold.** This plant grows in wet places almost everywhere, and is in flower in early summer.

Note the entire absence of hairs on the surface of the plant. It is therefore *glabrous*.

The root, like that of the Buttercup and of the Hepatica, is *fibrous*.

The stem is hollow and furrowed.

The foliage-leaves are of two kinds, as in the Buttercup. The radical leaves spring from the base of the stem, whilst the higher ones are cauline. The leaves are not lobed, as in the other two plants, but are indented on the edge. They are also net-veined.

23. Coming to the flower (Fig. 23) we find a circle, or whorl, of bright yellow leaves, looking a good deal like the petals of the Buttercup, but you will look in vain for the corresponding sepals. In this case there is no whorl of bracts to mislead you. Are we to say, then, that there is no calyx? If we adhere to the understanding mentioned when describing the Hepatica, we must suppose the *corolla* to be wanting, and then the bright yellow leaves of our plant will be the *sepals*, and will together constitute the calyx. As to the number of the sepals, you will find, as in the

Fig. 23.

Fig. 23.—F... and leaf of Marsh-Marigold.

Hepatica, some variation. Whilst the normal number is five, some flowers will be found to have as many as nine.

24. The stamens are next to be examined, but you should first satisfy yourselves as to whether the calyx is polysepalous or otherwise, and whether it is free from the other floral leaves or not. If your examination be properly made, it will show you that the calyx is free and polysepalous.

The stamens are very much like those of the Buttercup and Hepatica. They are numerous, they have both anthers and filaments, and they shed their pollen through slits on the outer edges of the anthers. They are all separate from each other (polyandrous), and are all inserted on the receptacle. On this latter account they are said to *hypogynous* (below the pistil).

25. Remove the stamens, and you have left, as before, a head of carpels (Fig. 24). Examine one: there is the lower broad part, which you recognize as the *ovary*, the very short style, and the sticky stigma. To all appearance the carpels are pretty much the same as those of the two plants already examined. It will not do, however, to trust altogether to appearances in this case. Cut open a carpel and you find that, instead of a single ovule at the bottom of the ovary, there are several ovules in a row along that edge of the ovary which is turned towards the centre of the flower. The ovary is, in fact, a *pod*, and, when the seeds ripen, splits open along its inner edge. If you can find one which has split in this way, you can hardly fail to be struck with the resemblance which it bears to a common leaf. (Fig. 25.)

Fig. 24.

Fig. 25.

Fig. 24.—Head of carpels of Marsh-Marigold.
Fig. 25.—Single carpel, opened to show the two rows of seeds.

On the whole the resemblance between the structure of the Marsh-Marigold and that of the Hepatica and Buttercup is sufficiently great to justify us in placing it in the same family with them.

26. Having now made yourselves familiar with the different parts of these three plants, you are to write out a tabular description of them according to the following form; and, in like manner, whenever you examine a new plant, do not consider your work done until you have written out such a description of it.

BUTTERCUP.

ORGAN OR PART OF FLOWER.	NO.	COHESION.	ADHESION.	REMARKS.
Calyx. *Sepals.*	5	Polysepalous.	Inferior.	
Corolla. *Petals.*	5	Polypetalous.	Hypogynous	Each Petal with a pit at the base inside
Stamens. *Filaments.* *Anthers.*	∞	Polyandrous.	Hypogynous.	
Pistil. *Carpels.* *Ovary.*	∞	Apocarpous.	Superior.	Carpels 1-seeded.

In the form the term *cohesion* relates to the union of *like* parts; for example, of sepals with sepals, or petals with petals; while the term *adhesion* relates to the union of *unlike* parts; for example, of stamens with coroll ovary with calyx. Neither cohesion nc hesion take place in any of the three flowers we have examine d accordingly, under these headings in our schedule we write down the terms polysepalous, polypetalous, &c., to indicate this fact.

HEPATICA.

ORGAN.	NO.	COHESION.	ADHESION.	REMARKS.
Calyx. *Sepals.*	7-12	Polysepalous.	Inferior.	Coloured like a corolla.
Corolla. *Petals.*				Wanting.
Stamens. *Filaments.* *Anthers.*	∞	Polyandrous.	Hypogynous.	
Pistil. *Carpels.* *Ovary.*	∞	Apocarpous.	Superior.	Carpels 1-seeded.

MARSH-MARIGOLD.

ORGAN.	NO.	COHESION.	ADHESION.	REMARKS.
Calyx. *Sepals.*	5-9	Polysepalous.	Inferior.	Coloured like a corolla.
Corolla. *Petals.*				Wanting.
Stamens. *Filaments.* *Anthers.*	∞	Polyandrous.	Hypogynous.	
Pistil. *Carpels.* *Ovary.*	∞	Apocarpous.	Superior.	Carpels contain several seeds.

The symbol ∞ means "indefinite," or "numerous," and may be used when the parts of any organ exceed ten in number.

Under the head "Remarks" you may describe anything worthy of notice, for which provision is not made elsewhere in the schedule.

If you use the exercise-book which has been prepared to accompany the text-book, you will find also space for *drawing* such parts as are not easy to describe in words.

27. The three plants upon which we have been engaged up to this point are representatives or *types* of a very large group, called by botanists *Ranunculaceæ*, that is, *Ranunculaceous plants*. All the members of it, whilst they may differ in certain minor characteristics, agree in all the more important respects. The minor differences such as we have observed in our examination of specimens, lead to the sub-division of the group into several smaller groups, but any plant exhibiting the peculiarities common to all three may be regarded as typical of the *Order*, which is the name given to the group as a whole. These common peculiarities may be summed up with sufficient accuracy for our present purpose, as follows :

1. *The circles of flower-leaves, that is to say, the sepals, petals, stamens, and carpels, are entirely distinct, and unconnected with each other.*
2. *The several members of each circle are also entirely separate from each other.*
3. *It may be added that the stamens are almost invariably numerous, and that the plants are acrid to the taste*

CHAPTER IV.

EXAMINATION OF OTHER COMMON PLANTS WITH HYPOGYNOUS STAMENS—SHEPHERD'S PURSE—ROUND-LEAVED MALLOW.

28. We shall now proceed to examine some plants, the flowers of which exhibit, in their structure, important variations from the Buttercup, Hepatica, and Marsh-Marigold.

Shepherd's Purse. This plant (Fig. 26) is one of the commonest of weeds. As in the Buttercup, the foliage-leaves are of two kinds, radical and cauline, the former being in a cluster around the base of the stem. The cauline leaves are all sessile, and each of them, at its base, projects backward on each side of the stem, so that the leaf somewhat resembles the head of an arrow. Such leaves are, in fact, said to be *sagittate*, or arrow-shaped. The flowers grow in a cluster at the top of the stem, and, as the season advances, the peduncle gradually elongates, until, at the close of the summer, it forms perhaps half of the entire length of the stem. You will observe in this plant, that each separate flower is raised on a little stalk of its own. Each of these little stalks is a *pedicel*, and when pedicels are present, the term peduncle is applied to the portion of stem which supports the whole cluster.

Fig. 27.

29. The flowers (Fig. 27) are rather small, and so will require more than ordinary care in their examination. The calyx is polysepalous, and of

Fig. 27.—Flower of Shepherd's Purse, enlarged.

Fig. 26.—Shepherd's Purse.

four sepals. The corolla is polypetalous, and of four petals. The stamens (Fig. 28) are six in number, and if you examine them attentively, you will see that two of them are shorter than the other four. The stamens are consequently said to be *tetradynamous*. But if there had been only *four* stamens, in two sets of two each, they would have been called *didynamous*. The stamens are inserted on the receptacle (hypogynous). The pistil is separate from the other parts of the flower (superior).

Fig. 28.

30. To examine the ovary, it will be better to select a ripening pistil from the lower part of the peduncle. It is a flat body, shaped something like a heart (Fig. 29), and having the short style in the notch. A ridge divides it lengthwise on each side. Carefully cut or pull away the lobes, and the ridge will remain, presenting now the appearance of a narrow loop, with a very thin membranous partition stretched across it. Around the edge, on both sides of the partition, seeds are suspended from slender stalks (Fig. 30). There are, then, *two carpels united together*, and the pistil is, therefore, *syncarpous*.

Fig. 29.

Fig. 30.

31. Shepherd's Purse is a type of a large and important Order, the *Cruciferæ*, or Cress Family. Other common examples, which should be studied and compared with Shepherd's Purse, are the garden Stock (*single* flowers are best for examination), Water-Cress, the yellow Mustard

Fig. 28.—The same, with calyx and corolla removed.
Fig. 29.—Ripened pistil of Shepherd's Purse.
Fig. 30.—The same, with one side removed to show the seeds.

of the wheat-fields, Radish, Sweet Alyssum of the gardens, &c. All these plants, while differing in unimportant particulars, such as the colour and size of the petals and the shape of the pod, agree in presenting the following characters:

1. *The sepals and petals are each four in number.*
2. *The stamens are tetradynamous (and hypogynous).*
3. *The fruit is syncarpous, and is 2-celled by reason of a thin partition stretched between the carpels.*
4. *It may be added that the plants are generally pungent to the taste, and the flowers are almost invariably in terminal clusters, like that of Shepherd's Purse.*

SHEPHERD'S PURSE.

Organ.	No.	Cohesion.	Adhesion.	Remarks.
Calyx. *Sepals.*	4	Polysepalous.	Inferior.	
Corolla. *Petals.*	4	Polypetalous.	Hypogynous.	
Stamens. *Filaments.* *Anthers.*	6	Tetradynamous.	Hypogynous.	Two sepals with a pair of long stamens opposite each; the other two with one short stamen opp. each.
Pistil. *Carpels.* *Ovary.*	2	Syncarpous.	Superior.	The two cells of the ovary separated by a thin partition.

32. **Mallow.** The round-leaved Mallow (Fig. 31) grows along every wayside, and is a very common weed in cultivated grounds. Procure, if possible, a plant which has ripened its seeds, as well as one in flower. The root of this plant is of a different kind from those of the three plants first examined. It consists of a stout tapering part, descending deep into the soil, from the surface of which fibres are given off irregularly. A stout root of this kind is called a *tap-root*. The carrot is another example.

Fig. 32.

Fig. 33.

Fig. 34.

Fig. 31.

33. The leaves are long-petioled, net-veined, and indented on the edges. On each side of the petiole, at its junction with the stem, you will observe a little leaf-like attachment, to which the name *stipule* is given. The presence or absence of stipules is a point of some importance in plant-structure, and you will do well to notice it in your examinations. You have now made yourselves

Fig. 31.—Round-leaved Mallow. Fig. 32.—Section of the flower.
Fig. 33.—Flower with calyx and corolla removed.
Fig. 34.—A ripened pistil with the persistent calyx.

acquainted with all the parts that any leaf has, viz., *blade*, *petiole*, and *stipules*.

34. Coming to the flower, observe first that the parts of the calyx are not entirely separate, as in the flowers you have already examined. For about half their length they are united together so as to form a cup. The upper half of each sepal, however, is perfectly distinct, and forms a *tooth* of the calyx; and the fact that there are five of these teeth shows us unmistakably that the calyx is made up of five sepals. We therefore speak of it as a *gamosepalous* calyx, to indicate that the parts of it are coherent.

As the calyx does not fall away when the other parts of the flower disappear, it is said to be *persistent*. Fig. 31, *a*, shows a persistent calyx.

35. At the base of the calyx there are three minute leaf-like teeth, looking almost like an outer calyx. A circle of bracts of this kind is called an *involucre*. The three bracts under the flower of the Hepatica also constitute an involucre. As the bracts in the Mallow grow on the calyx, some botanists speak of them as an *epicalyx*.

The corolla consists of five petals, separate from each other, but united with the stamens at their base.

36. The stamens are numerous, and as their filaments are united to form a tube, they are said to be *monadelphous*. This tube *springs from the receptacle*, and the stamens are therefore *hypogynous*. Fig. 32 will help you to an understanding of the relation between the petals and stamens.

Having removed the petals, split the tube of the stamens with the point of your needle. A little care will then enable you to remove the stamens without injuring the

pistil. The latter organ will then be found to consist of a ring of coherent carpels, a rather stout style, and numerous long stigmas (Fig. 33). If you take the trouble to count the carpels and the stigmas, you will find the numbers to correspond. As the seeds ripen, the carpels separate from each other (Fig. 34).

MALLOW.

Organ.	No.	Cohesion.	Adesion.	Remarks.
Calyx.		Gamosepalous.	Inferior.	Three bracts growing on the calyx.
Sepals.	5			
Corolla.		Polypetalous.	Hypogynous.	
Petals.	5			
Stamens.	∞	Monadelphous	Hypogynous.	
Filaments.				
Anthers.		One-celled.		
Pistil.	∞	Syncarpous.	Superior.	Carpels as many as the stigmas.
Carpels.				
Ovary.				

37. Compare now the structure of the Hollyhock (single flowers should be selected) with that of the Mallow, and write out a description. Musk-Mallow and Abutilon (a common green-house plant) may also be examined with advantage.

38. The Order *(Malvaceæ)* of which Mallow is a type is very distinctly marked by the following characteristics:

1. *The sepals are always placed edge to edge (valvate) in the bud, while the petals overlap and are rolled together (convolute).*
2. *The stamens are numerous and monadelphous, and their anthers are 1-celled. Although united at the*

base with the claws of the petals, they are nevertheless inserted on the receptacle (hypogynous).

3. *The carpels are almost always united in a ring, which breaks up at maturity.*

4. *It may be added that the leaves are furnished with stipules, and the juice of the plants is mucilaginous.*

CHAPTER V.

EXAMINATION OF COMMON PLANTS WITH PERIGYNOUS STAMENS—GARDEN PEA—GREAT WILLOW-HERB.

39. Garden Pea. In the flower of this plant, the calyx is constructed on the same plan as in the Mallow. There are five sepals, coherent below, and spreading out into distinct teeth above (Fig. 35). The calyx is therefore gamosepalous.

Fig. 36. Fig. 35.

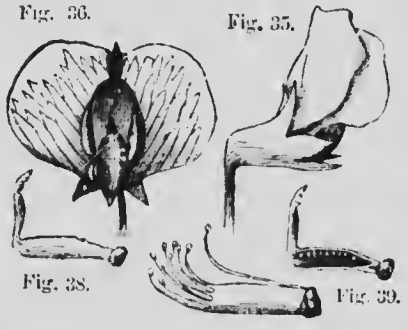

Fig. 38. Fig. 39.

Fig. 37.

Examine next the form of the corolla (Fig. 36). One difference between the corolla and those of the previous plants will strike you at once. In the flowers of the latter you will remember that each petal was precisely like its fellows in size and shape, and we therefore spoke of the corolla as *regular*. In the Pea, on the other hand,

Fig. 35.—Flower of Garden Pea. Fig. 36.—Front view of the same.
Fig. 37.—Diadelphous stamens of the same.
Fig. 38.—The pistil. Fig. 39.—The same cut through lengthwise.

one of the petals is large, broad, and open, whilst two smaller ones, in the front of the flower, are united into a kind of hood. We shall speak of this corolla, then, and all others in which the petals are unlike each other in size or shape, as *irregular*.

As the Pea blossom bears some resemblance to a butterfly, it is said to be *papilionaceous*.

40. Remove now the calyx-teeth and the petals, being very careful not to injure the stamens and the pistil, enveloped by those two which form the hood. Count the stamens, and notice their form (Fig. 37). You will find ten, one by itself, and the other nine with the lower halves of their filaments joined together, or coherent. When stamens occur in this way, in two distinct groups, they are said to be *diadelphous*; if in three groups, they would be *triadelphous*; if in several groups, *polyadelphous*. In the Mallow, you will remember, they are united into *one* group, and therefore we described them as *monadelphous*.

You will, perhaps, be a little puzzled in trying to determine to what part of the flower the stamens are attached. If you look closely, however, you will see that the attachment, or *insertion*, is not quite the same as in the Buttercup and the other flowers examined. In the present instance they are inserted upon the lower part of the calyx, and so they are described as *perigynous*, a term meaning "around the pistil."

41. But the pistil (Figs. 38, 39) is not attached to the calyx. It is *free*, or *superior*. If you cut the ovary across, you will observe there is but one cell, and if you examine the stigma, you will find that it shows no sign of division. You may therefore be certain that the pistil is a single carpel.

You are now prepared to fill up the schedule descriptive of this flower.

GARDEN PEA.

ORGAN.	NO.	COHESION.	ADHESION.	REMARKS.
Calyx. *Sepals.*	5	Gamosepalous	Inferior.	
Corolla. *Petals.*	5	Papilionaceous. Irregular.	Perigynous.	The two front petals united.
Stamens. *Filaments.* *Anthers.*	10.	Diadelphous.	Perigynous.	
Pistil. *Carpels.* *Ovary.*	1	Apocarpous.	Superior.	

42. The beginner will be very likely to think, from its appearance, that the largest of the petals is made up of two coherent ones, but the following considerations show clearly that this is not the case. In the Buttercup, and other flowers in which the number of sepals and petals is the same, the petals do not stand before the sepals, but before the spaces between them. In the Pea-blossom this rule holds good if the large petal is considered as one, but not otherwise. Again, the veining of this petal is similar to that of a common leaf, there being a central rib from which the veins spring on each side; and lastly, there are some flowers of the Pea kind—Cassia, for example—in which this particular petal is of nearly the same size and shape as the other four.

43. The Pea is a type of a highly important group of plants—the Order *Leguminosæ*. To it belong many plants

liffering very widely in external appearance—the Locust-Tree and the Clover, for example—but exhibiting in the structure of their flowers so marked a similarity that their relationship is beyond question. The characters by which the Order is distinguished are chiefly these:

1. *The corolla is more or less papilionaceous, and is inserted on the base of the calyx* (*perigynous*).
2. *The stamens, almost invariably ten in number, are also perigynous, and nearly always diadelphous.*
3. *The pistil is nearly always a legume, that is to say, it is a single carpel which splits into two pieces at maturity, like the pod of the Pea or Bean.*
4. *The leaves have stipules, and are nearly always compound, that is, of several distinct leaflets.*

Plants which may be compared with the Pea are Red Clover, White Clover, Sweet Clover, Medick, Locust-Tree, Bean, Vetch, Lupine, Sweet Pea, &c.

44. **Great Willow-herb.** This plant is extremely common in low grounds and newly-cleared land, and you may easily recognize it by its tall stem and bright purple flowers.

Fig. 40.

Observe the position of the flowers. In the three plants first examined we found the flowers at the end of the stem. In the Willow-herb, as in the Mallow, they spring from the sides of the stem, and immediately below the point from which each flower springs you will find a small leaf or bract (Fig. 40). Flowers

Fig. 40.—Flower of Great Willow-herb.

which arise from the axils of bracts are said to be *axillary*, whilst those which are at the ends of stems are called *terminal*, and you may remember that flowers can only be produced in the axils of leaves and at the ends of stems and branches.

45. Coming to the flower itself, direct your attention, first of all, to the position of the ovary. You will find it apparently under the flower, in the form of a tube tinged with purple. It is not in reality under the flower, because its purplish covering is th calyx, or, more accurately, the *calyx-tube*, which adheres to the whole surface of the ovary, and expands above into four long teeth. The ovary, therefore, is *inferior*, and the calyx, of course, *superior*, in this flower. As the sepals unite below to form the tube the calyx is gamosepalous.

The corolla consists of four petals, free from each other, and is consequently polypetalous. It is also regular, the petals being alike in size and shape. Each petal is narrowed at the base into what is called the *claw* of the petal, the broad part, as in the ordinary foliage-leaf, being the *blade*. The stamens are eight in number (octandrous), four short and four long, and are attached to the calyx (perigynous).

Fig. 42.

Fig. 41.

46. The pistil has its three parts—ovary, style, and stigma—very distinctly marked. The stigma consists of four long lobes, which curl outwards after the flower opens. The

Fig. 41.—Ripened pistil of Willow-herb. Fig. 42.—Cross section of the same.

style is long and slender. The examination of the ovary requires much care; you will get the best idea of its structure by taking one which has just burst open and begun to discharge its seeds (Fig. 41). The outside will then be seen to consist of four pieces (*valves*), whilst the centre is occupied by a slender four-winged column (Fig. 42), in the grooves of which the seeds are compactly arranged. The pistil thus consists of four carpels united together, and is therefore *syncarpous*. Every seed is furnished with a tuft of silky hairs, which greatly facilitates its transportation by the wind.

47. The Willow-herb furnishes an excellent example of what is called *symmetry*. We have seen that the calyx and corolla are each made up of four parts; the stamens are in two sets of four each; the stigma is four-lobed, and the ovary has four seed-cells. A flower is *symmetrical* when each set of floral leaves contains either the same number of parts or a *multiple* of the same number.

Observe that the leaves of our plant are net-veined.

The schedule will be filled up as follows:

GREAT WILLOW-HERB.

ORGAN.	NO.	COHESION.	ADHESION.	REMARKS.
Calyx. *Sepals.*	4	Gamosepalous	Superior.	
Corolla. *Petals.*	4	Polypetalous.	Perigynous.	
Stamens. *Filaments. Anthers.*	8	Octandrous.	Perigynous.	Four short and four long.
Pistil. *Carpels. Ovary.*	4	Syncarpous.	Inferior.	Seeds provided with tufts of hair.

Flowers to compare with Great Willow-herb are Fuchsia and Evening Primrose. Either of these will serve as the type if Willow-herb cannot be obtained.

CHAPTER VI.

EXAMINATION OF COMMON ROSACEOUS PLANTS—SWEET BRIER—STRAWBERRY—CHERRY—CRAB APPLE—RASPBERRY.

48. **Sweet Brier.** As in the flowers examined in the last chapter, the sepals of Sweet Brier are not entirely distinct; their lower halves cohere to form a tube, and the calyx is therefore gamosepalous.

Fig. 43.

The corolla consists of five separate petals of the same size and shape, and is therefore both regular and polypetalous.

The stamens are very numerous, and separate from each other. As in the Pea and the Willow-herb, so in this flower they will be

Fig. 43.—Flower and leaves of Sweet Brier.

found to be attached to the calyx. They are, therefore, *perigynous*.

49. To understand the construction of the pistil, you must make a vertical section through the roundish green mass which you will find on the under side of the flower.

Fig. 44.

You will then have presented to you some such appearance as that in Fig. 44. The green mass, you will observe, is hollow. Its outer covering is simply the continuation of the calyx-tube. *The lining of this calyx-tube is the receptacle of the flower;* to it are attached the separate carpels which together constitute the pistil (Fig. 45), just as the carpels of the Buttercup are attached to the *raised* receptacle of that flower.

We must remind you again that whenever the ovary is enclosed in the calyx-tube, and the calyx appears to spring from the summit of the ovary, the latter is said to be *inferior*, and the former *superior*.

In the case of Sweet Brier and similar forms, where the pistil is strictly apocarpous, and the other parts cohere at their base so as to form a tube enclosing the really free carpels, the pistil may be described as *half-inferior*, and the calyx consequently as *half-superior*.

Fig. 45.

50. **Strawberry.** So far as calyx, corolla, and stamens are concerned, the flower of Strawberry very nearly resembles that of Sweet Brier. Alternating with the five calyx-lobes, however, will be found five bractlets,

Fig. 44.—Vertical section through the pistil.
Fig. 45.—Vertical section through ripe fruit of Sweet Brier.

which constitute, as in Mallow, an *epicalyx*. The pistil must be carefully examined. In this case there will be found a conical elevation in the centre of the flower, on the surface of which are inserted many separate carpels, much in the same way as in Buttercup. At maturity this elevated receptacle will have become greatly enlarged and pulpy, with the real fruit, the ripened carpels, dotted over its surface (Fig. 46).

Fig. 46.

51. **Cherry** or **Plum**. Here also the calyx, corolla, and stamens are all adherent, and a hollow cup is formed, in the bottom of which (but entirely free from these parts) the pistil is developed (Fig. 47). It consists of a single carpel, in which there are at first two ovules, though generally but one seed is ripened. The fruit is called a *drupe*, the seed being surrounded by three distinct layers: (1) a hard shell (the *putamen*), (2) a mass of soft pulp, and (3) the outer skin.

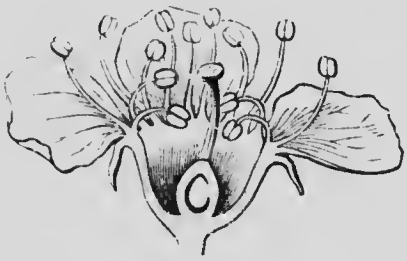

Fig. 47.

52. **Crab-Apple**. Here, as before, we have a gamosepalous calyx, the lower part forming a tube. The five petals are separate and inserted on the calyx, as are also the numerous stamens. To understand the structure of the pistil, make a vertical section through the centre of the flower, and also a cross section. The cross section

Fig. 46.—Vertical section of Strawberry.
Fig. 47.—Vertical section through flower of Cherry. (Gray.)

(Fig. 50) will show you that in this case we have a syncarpous pistil of five carpels, and the vertical section (Fig. 49) shows that the ovary is here truly *inferior*, the calyx-tube being completely adherent or *adnate* to it. The style is divided into five parts, corresponding to the five carpels.

Fig. 48. Fig. 49.

53. At maturity, whilst the pistil or central organ has enlarged considerably, it will be found that the calyx-tube, which is adherent to it, has also grown very much. It is, in fact, the largely developed calyx-tube which constitutes the edible part of the apple, the true pistil forming the core. It is not very easy to distinguish the line which separates these two parts of the ripe fruit, but if a cross-section be made through the apple a circle of greenish dots may generally be made out at the outer limit of the core. A fruit of this sort is called a *pome*. The withered calyx-teeth may be found in the hollow at the end opposite the stem, as also, generally, the remains of the five styles.

Fig. 50.

Fig. 48.—Flower of Crab-Apple. Fig 49.—Vertical section of ovary.
Fig. 50.—Cross section of fruit of Crab-Apple.

54. **Raspberry**. Calyx, corolla, and stamens have the same arrangement as in Strawberry, and the pistil is likewise apocarpous, the numerous carpels covering the surface of a raised receptacle. But here the carpels do not produce *achenes*. Each of them at maturity forms a fruit resembling a drupe, so that the raspberry is a mass of drupes heaped upon a common receptacle.

55. Let us now sum up our observations upon the representatives of the great Order of Rosaceous plants. We have found them to possess the following characters in common:

1. *The petals and the numerous stamens are inserted on the calyx* (*perigynous*).
2. *The pistil, except in the Apple, is apocarpous and free from the calyx.*
3. *It may be added that the leaves are furnished with stipules.*

56. The differences (which lead to the sub-division of the Order into subordinate groups) are chiefly in the fruit. In Sweet Brier, with which may be compared any wild Rose, the achenes are enclosed in the calyx-tube. In Strawberry the receptacle is conical; so also in Raspberry. In the Cherry the carpel is single, forming a drupe. In the Apple the ovary is syncarpous and combined with the fleshy calyx. Compare with the Apple the Hawthorn and the Mountain Ash or Rowan Tree.

57. The following are the schedules descriptive of Sweet Brier and Crab-Apple. Those relating to Cherry, Strawberry, and Raspberry should be carefully filled up by the pupil.

SWEET BRIER.

Organ.	No.	Cohesion.	Adhesion.	Remarks.
Calyx. *Sepals.*	5	Gamosepalous	Half superior.	
Corolla. *Petals.*	5	Polypetalous.	Perigynous.	
Stamens.	∞	Polyandrous.	Perigynous.	
Pistil. *Carpels.*	∞	Apocarpous.	Half-inferior.	The hollow receptacle lines the calyx-tube

CRAB-APPLE.

Organ.	No.	Cohesion.	Adhesion.	Remarks.
Calyx. *Sepals.*	5	Gamosepalous.	Superior.	
Corolla. *Petals.*	5	Polypetalous.	Perigynous.	
Stamens.	∞	Polyandrous.	Perigynous.	
Pistil. *Carpels.*	5	Syncarpous.	Inferior.	Fruit consists chiefly of a fleshy enlargement of the calyx-tube.

CHAPTER VII.

EXAMINATION OF A PLANT WITH EPIGYNOUS STAMENS—WATER-PARSNIP.

58. **Water-Parsnip.** This is a common swamp plant in Canada; but if any difficulty be experienced in procuring specimens, the flower of the common Carrot or Parsnip or of Parsley may be substituted for it, all these plants being closely related, and differing but slightly in the structure of their flowers.

Fig. 53. Fig. 52. Fig. 51.

Notice first the peculiar appearance of the flower cluster (Fig. 51). There are several pedicels, nearly of the same length, radiating from the end of the peduncle, and from the end of each pedicel radiate in like manner a number of smaller ones, each with a flower at its extremity. Such a cluster is known as an *umbel*. If, as in the present case, there are groups of secondary pedicels, the umbel is *compound*. As the flowers are very small we shall be obliged to use the lens all through the examination. Even with its aid you will have a little difficulty in making out the calyx, the tube of which, in this flower, adheres to the surface of the ovary, as in Willow-herb, and is reduced above to a mere rim or border of five minute teeth. The petals are five in number, and free from each other. Observe that each of them is *incurved* at its extremity

Fig. 51.—Compound umbel of Water-Parsnip.
Fig. 52.—Single flower of same. Fig. 53.—Vertical section of the ovary.

(Fig. 52). They are inserted *on a disk which crowns the ovary*, as are also the five stamens, which are hence said to be *epigynous*. In the centre of the flower are two short styles projecting above the disk, and a vertical section through the ovary (Fig. 53) shows it to be two-celled, with a single seed suspended from the top of each cell.

WATER-PARSNIP.

ORGAN.	NO.	COHESION.	ADHESION.	REMARKS.
Calyx. *Sepals.*	5	Gamosepalous	Superior.	Calyx-teeth almost obsolete.
Corolla. *Petals.*	5	Polysepalous.	Epigynous.	Petals incurved.
Stamens.	5	Pentandrous.	Epigynous.	
Pistil. *Carpels.*	2	Syncarpous.	Inferior.	

59. The Water-Parsnip is a type of the large Order *Umbellifer*æ, which is well marked by the following characters :

1. *The flowers are clustered in umbels, and these are generally compound.*
2. *The calyx is perfectly adherent to the ovary, so that almost none of it projects above.*
3. *The petals and stamens (five each) are epigynous.*
4. *The ovary is two-celled, and is surmounted by two styles. At maturity the pistil separates into two dry carpels.*

CHAPTER VIII.

EXAMINATION OF COMMON PLANTS WITH EPIPETALOUS STAMENS—DANDELION—CATNIP.

60. **Dandelion.** The examination of this flower will be somewhat more difficult than that of any we have yet undertaken.

Fig. 54.

Provide yourselves with specimens in flower and in seed.

The root of the plant, like that of the Mallow, is a tap-root.

The stem is almost suppressed, and, as in the case of the Hepatica, the leaves are all radical. They are also net-veined.

The flowers are raised on scapes, which are hollow. At first sight the flower appears to have a calyx of many sepals, and a corolla of many petals. Both of these appearances, however, are contrary to facts. With a sharp knife cut the flower through the middle from top to bottom (Fig. 54). It will then appear that the flower, or rather *flower-head*, is made up of a large number of distinct pieces. With the point of your needle detach one of these pieces. At the lower end of it you have a small body resembling an unripe seed (Fig. 55). It is, in fact, an ovary. Just above this there is a short bit of stalk, surmounted by a circle of silky hairs, and above this a yellow tube with one side greatly prolonged. This yellow tube is a corolla, and a close examination of the extremity of

Fig. 55.

Fig. 54.—Vertical section of Dandelion flower.
Fig. 55—Single floret.

its long side will show the existence of five minute points, or teeth, from which we infer that the tube is made up of five coherent petals. As the corolla is on the ovary, it is said to be *Epigynous.*

Fig. 56.

Out of the corolla protrudes the long style, divided at its summit into two stigmas.

To discern the stamens will require the greatest nicety of observation. Fig. 56 will help you in your task. The stamens are five in number. They are inserted on the tube of the corolla (*epipetalous*) and their anthers cohere (Fig. 57), and form a ring about the style. When the anthers are united in this way, the stamens are said to be *syngenesious.*

61. It appears, then, that the Dandelion, instead of being a single flower, is in reality a compound of a great many flowers upon a common receptacle, and what seemed at first to be a calyx is, in reality, an *involucre*, made up of many bracts.

Fig. 57.

Fig. 58.

But have the single flowers, or *florets*, as they are properly called, no calyx? The theory is ... they have one, but that it is adherent to the surface of the ovary, and that the tuft of silky hairs which we noticed is a prolongation of it.

Now turn to your specimen having the seeds ready to blow away. The seeds are all single; the little bit of stalk at the top has grown into a long slender thread, and the tuft of hairs has spread out like the rays of an umbrella (Fig. 58). But though the seeds are

Fig. 56.—Corolla laid open to show epipetalous stamens.
Fig. 57.—Syngenesious anthers of Dandelion. Fig. 58.—Fruit of Dandelion.

invariably single, it is inferred from the two-lobed stigma that there are *two carpels*. The following is the schedule:

DANDELION.

ORGAN.	No.	COHESION.	ADHESION.	REMARKS.
Calyx. *Sepals.*	5	Gamosepalous	Superior.	The number of sepals is *inferred from analogy* to be five.
Corolla. *Petals.*	5	Gamopetalous	Epigynous.	
Stamens.	5	Syngenesious.	Epipetalous.	
Pistil. *Carpels.*	2	Syncarpous.	Inferior.	Number of carpels inferred from number of stigmas.

62. Flowers constructed on the plan of the Dandelion are called *Composite* flowers. The Order (Compositæ) comprises an immense number of common plants, in some of which all the corollas in the head are, as in the Dandelion, of one sort, namely, with one side prolonged into a strap, and hence called strap-shaped or *ligulate*. In most cases, however, the ligulate corollas form a circle round the margin of the head only, as in Sunflower, while the central *disk* is filled up with small regular gamopetalous corollas with a five-toothed border. Or it may happen, as in Thistle, that all the flowers are regular, ligulate corollas being absent. These, however, are minor points, and, while serving to distinguish subordinate groups, do not interfere with the great and salient characters which mark the Order as a whole. So, also

instead of the tuft of silky hairs (technically called the *pappus*) which surmounts the ovary, there may be, as in Sunflower, a few teeth-like projections, or scales, or a mere rim hardly to be distinguished at all.

63. The Order is easily recognized by the following characters:

1. *The flowers, or florets, are in heads on a common receptacle, and surrounded by an involucre.*
2. *The stamens are inserted on the corolla, and are united by their anthers (syngenesious).*
3. *The style is 2-lobed at the apex.*

64. Representatives of this Family are so numerous that it is needless to give a list. Specimens exhibiting all the variations in regard to the corollas, pappus, &c., should be gathered and notes made of their structure. In Part II. will be found a very full account of all the species likely to be met with, and the exercise book has a number of blank schedules specially arranged for Composites.

65 **Catnip.** Note carefully the appearance of the stem. It is *square*.

The flowers are in axillary clusters. The calyx is a tube (Fig. 59), terminating in five sharp teeth, and you may observe that the tube is a little longer on the upper side (that is, the side *towards* the stem) than on the lower. The corolla is somewhat peculiar. It has somewhat the appearance of a wide-open mouth, and is known as a *labiate* or two-lipped corolla. The upper lip is erect and notched at the apex.

Fig. 59.

Fig. 59.—Flower of Catnip.

The lower lip spreads outward, and consists of a large central lobe and two small lateral ones. Altogether, therefore, there are *five* lobes constituting the gamopetalous corolla. Pull out the corolla, and with the point of your needle split its tube in front. On laying it open, the stamens will be found to be inserted upon it (epipetalous). They are four in number, two of them longer than the other two. Hence they are described as *didynamous*. The anthers are peculiar in not having their lobes parallel (Fig. 60), these being wide apart at the base, in consequence of the expansion of the *connective*, the name given to that part of the anther which unites its two lobes or cells.

Fig. 60.

The pistil consists of a two-lobed stigma, a long style, and an ovary which seems at first as if made up of four distinct carpels (Fig. 61). But the two-lobed stigma will warn you against this supposition. The ovary really consists of *two* carpels, each of two deep lobes, and, as the seeds ripen, these lobes form four little nutlets (Fig. 62), each containing a single seed.

Fig. 61.

Fig. 62.

66. The Catnip is a type of the Order *Labiatæ* (Mint Family), so called because the corollas are usually labiate. It is marked by the following characters:

1. *The stem is square, and the leaves are opposite and generally aromatic.*
2. *The corolla is more or less labiate.*
3. *The stamens are mostly didynamous.*

Fig. 60.—Front view of the same. Fig. 61.—Pistil of Catnip.
Fig. 62.—Ripe ovary of four separate nutlets.

4. The ovary is four-lobed, and at maturity breaks up into four nutlets.

Other types are the various Mints, Sage, Thyme, Summer Savory, Pennyroyal, Bergamot, Self-heal, Horehound, &c., many of which are of very common occurrence.

CATNIP.

Organ.	No.	Cohesion.	Adhesion.	Remarks.
Calyx.	1	Gamosepalous	Inferior.	Calyx-tube nerved.
Sepals.	5			
Corolla.		Gamopetalous	Hypogynous.	Two-lipped. Upper lip of two, and lower of three, lobes.
Petals.	5			
Stamens.	4	Didynamous.	Epipetalous.	Lobes of anthers not parallel.
Anthers.				
Pistil.		Syncarpous.	Superior.	The ripe ovary of four nutlets.
Carpels.	2			

CHAPTER IX.

EXAMINATION OF PLANTS WITH MONŒCIOUS FLOWERS—CUCUMBER—OAK.

67. **Cucumber.** You can hardly have failed to notice that only a small proportion of the blossoms on a Cucumber vine produce cucumbers. A great many

wither away and are apparently of no use. An attentive inspection will show that some of the blossoms have oblong fleshy protuberances beneath them, whilst others are destitute of these attachments. Select a flower of each kind, and examine first the one with the protuberance (Fig. 63), which latter, from its appearance you will probably have rightly guessed to be the ovary. The situation of the ovary here, indeed, is the same as in the Willow-herb. The calyx-tube adheres to its surface, and is prolonged to some little distance above it, expanding finally into five teeth. The corolla is gamopetalous, and is adherent to the calyx. Remove now the calyx and the adherent corolla, and there is left in the centre of the flower a short column, terminating in three stigmas, each two-lobed.

Fig. 63.

There are no stamens.

68. Now examine the other blossom (Fig. 64). Calyx and corolla have almost exactly the same appearance as before. Remove them, and you have left three stamens growing on the calyx-tube, and slightly united by their anthers (synœnesious). *There is no pistil.*

Fig. 64.

Fig. 63.—Pistillate flower of Cucumber.
Fig. 64.—Staminate flower of Cucumber.

You see now why some blossoms produce cucumbers and others do not. Most of the blossoms have no pistil, and are termed *staminate* or *sterile* flowers, whilst the others are *pistillate* or *fertile*. Flowers in which either stamens or pistils are wanting are also called *imperfect*. When staminate and pistillate flowers grow on the same plant, as they do in the case of the Cucumber, they are said to be *monœcious*.

69. In plants of this kind the pollen of one kind of blossom is conveyed to the stigmas of the other kind, chiefly by insects, which visit the flowers indiscriminately in search of honey. The pollen dust clings to their hairy legs and bodies, and is presently rubbed off upon the stigma of some fertile flower.

70. In order to describe monœcious flowers, our schedule will require a slight modification. As given below, the symbol ♂ stands for "staminate flower," and the symbol ♀ for "pistillate flower."

CUCUMBER.

Organ.	No.	Cohesion.	Adhesion.	Remarks.
Calyx. *Sepals.*	5	Gamosepalous	Superior.	
Corolla. *Petals.*	5	Gamopetalous	Perigynous.	
♂ Stamens.	3	Syngenesious.	Perigynous.	Two anthers are 2-celled and one 1-celled.
♂ Pistil. *Carpels.*	0			
♀ Stamens.	0			
♀ Pistil. *Carpels.*	3	Syncarpous.	Inferior.	

71. Oak. The Oaks are among our finest and most valuable forest-trees, and while everyone is familiar with

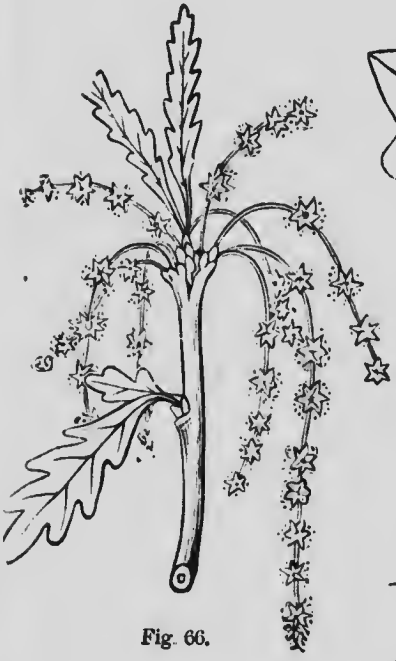

Fig. 66.

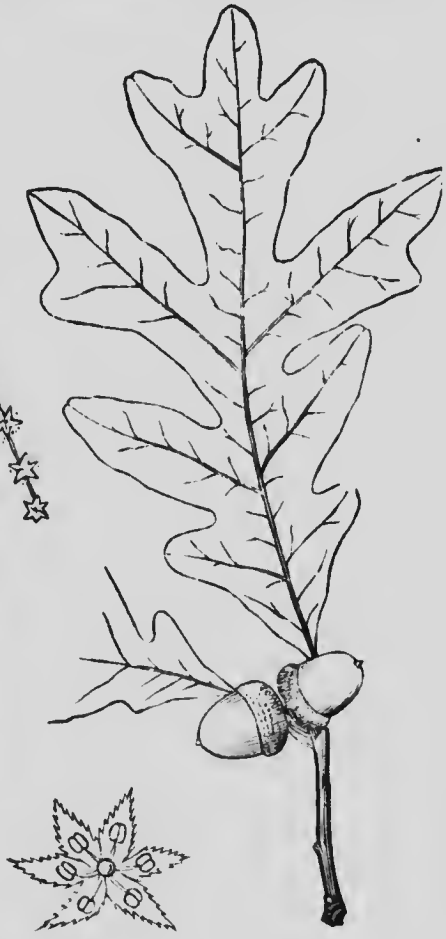

Fig. 65.

Fig. 67.

the appearance of the *acorn*, as the fruit of the Oak is

Fig. 66.—Twig of White Oak with sterile catkins.
Fig. 67.—Single staminate flower.
Fig. 68.—Fruit and leaf of Oak. (Wood and Steele.)

called, the fact that the flowers are not to be obtained without effort on account of their distance from the ground, as well as the circumstance of their being rather inconspicuous, may lead to their being overlooked unless special attention is directed to them. The White Oak is perhaps the best known species with us. It may be pretty well distinguished from other species by its leaves, the lobes of which (Fig. 65) are *rounded*. However, for the purposes of this lesson, any other species may be used, if the White Oak is not at hand. The flowers are monœcious, the sterile ones forming long and slender drooping catkins, which are either single or, more generally, several in a cluster, from the same lateral bud (Fig. 66). Each sterile flower (Fig. 67) consists of a perianth or calyx of a variable number of sepals, mostly from four to six, and generally eight stamens. The fertile flowers spring mostly from the axils of the leaves of new shoots, and they occur either singly or two or three in a cluster. Each flower consists of a syncarpous pistil of three carpels. The ovary is three-celled, or nearly so, and two ovules are formed in each cell. The flower is surrounded at the base by a scaly involucre, which, at maturity, has become quite woody, and forms in fact the *cup* in which the acorn rests. If you dissect an acorn you will observe that *there is but one seed in it*. Although the ovary contains six ovules at starting, it always happens that all but one disappear before the fruit is matured.

The White Oak ripens its acorns the first year. The Red Oak, on the other hand, does not ripen its fruit till the autumn of the second year.

72. It will be a valuable exercise to compare flowers of the Beech with those just described. They will be found

to be monœcious also; the sterile ones in small drooping heads, with stamens and sepals variable in number, and the fertile ones from the axils of new leaves, usually two together, surrounded by an involucre of many bristle-pointed scales. These develope into the familiar bristly four-valved involucre which encloses the pair of three-cornered nuts at maturity. Each nut is the product of one flower, and contains but one seed, although at first the ovary was (like that of the Oak) three-celled, with two ovules in each cell.

These resemblances lead us to the conclusion that the Oak and the Beech are nearly related plants. They belong to the same Order (*Cupuliferæ*), as do also the Ironwood, the Chestnut, and the Hazelnut, all of which should be examined and compared, if within reach.

73. The following are the distinguishing characters of the Order:

1. *The flowers are monœcious, the sterile ones being in catkins (or, in Beech, in close heads), the fertile single or in small clusters, with an involucre forming at maturity a cup or covering for the 1-seeded nut*
2. *The ovary is at first several-celled, but at maturity is 1-celled and 1-seeded.*

The pupil will write out description of one or more representatives of the Order, taking the description of Cucumber for his model.

CHAPTER X.

EXAMINATION OF PLANTS WITH DIŒCIOUS FLOWERS—WILLOW—MAPLE.

74. **Willow.** The flowers of most kinds of Willow appear in spring or early summer before the leaves. They grow from the axils in long, close clusters called *catkins* or *aments*. Collect a few of these *from the same tree or shrub*. You will find them to be exactly alike. If the first one you examine is covered with yellow stamens (Fig. 68), all the rest will likewise consist of stamens, and you will search in vain for any appearance of a pistil. If, on the other hand, one of your catkins is evidently destitute of stamens, and consists of oblong pistils (Fig. 69), then all the others will in like manner be found to be without stamens. Unlike our Cucumber plant, the staminate and pistillate flowers of the Willow are borne on *different* plants. These flowers are therefore said to be *diœcious*. As a general thing, staminate and pistillate catkins will be found upon trees not far apart. Procure one of each kind, and examine first the staminate one. You will probably find the stamens in pairs. Follow any pair of filaments down to

Fig. 68.

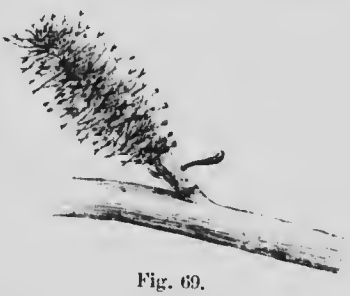

Fig. 69.

Fig. 70.

Fig. 68.—Staminate catkin of Willow. Fig. 69.—Fertile catkin.
Fig. 70.—Single staminate flower.

their insertion, and observe that they spring from the axil of a minute bract (Fig. 70). These bracts are the *scales* of the catkin. There is no appearance of either calyx or corolla, and the flowers are therefore said to be *achlamydeous*, that is, without a covering. Now look at the fertile catkin. Each pistil will, like the stamens, be found to spring from the axil of a scale (Fig. 71). The stigma is two-lobed, and, on carefully opening the ovary, you observe that though there is but one cell yet there are *two rows of seeds*. We therefore infer that the pistil consists of two carpels. The pistillate flowers, like the staminate, are achlamydeous. In diœcious plants

Fig. 71.

HEART-LEAVED WILLOW.

ORGAN.	No.	COHESION.	ADHESION.	REMARKS.
Calyx.	0			
Corolla.	0			
♂ Stamens.	2	Diandrous.	0	
♂ Pistil.	0			
♀ Stamens.	0			
♀ Pistil.		Syncarpous.	0	
Carpels.	2			

the process of fertilization is assisted by insects, especially when the flowers are showy or odoriferous and nectar-

Fig. 71.—Single pistillate flower of Willow.

bearing; otherwise the wind is the principal agent. Flowers which depend on insects to effect the transfer of pollen from the anther to the stigma are said to be *entomophilous*. Those which depend upon the wind are *anemophilous*. The Willow belongs to the former class.

75. **Maple.** In early spring, while the branches are as yet bare of leaves, our Red Maples are covered with a profusion of scarlet and yellow blossoms, and the air about them is alive with busy insects gathering honey for themselves, and performing at the same time an important service for the trees in return; for it will be found on examining a few of the trees that, like the Willow, they do not all bear the same kind of flowers. In some, the ends of the reddish twigs will present the appearance shown in Fig. 72, with numerous stamens protruding from the scaly lateral buds. On looking into one of these buds it will be found that there are several flowers on short pedicels, each like that shown in Fig. 73, except that the number of stamens will probably be found to be somewhat variable. Observe the fleshy disk in the bottom of the calyx, upon which the stamens are inserted. These flowers with the projecting stamens are without pistils. They produce nothing but pollen, and the tree upon which you find them produces no other kind.

Fig. 72.

Fig. 73.

Fig. 72. Twig of Red Maple bearing staminate flowers.
Fig. 73.—Single staminate flower. (Wood & Steele).

In other trees, the twigs will be found to resemble Fig. 74. The scaly buds are present, and the clusters of flowers within them as before, but the projecting stamens are wanting. If stamens are present at all, they are short and almost concealed in the calyx, as shown in Fig. 75, where two anthers are just visible over the edge of the calyx. The centre of the flower is occupied by a syncarpous pistil, having a two-celled ovary and two long styles, as shown in the figure.

Fig. 74.

Fig. 75.

The flowers of the Maple, therefore, being sterile or staminate upon one tree, and fertile or pistillate upon another, are, as in Willow, said to be diœcious; or, if we take into account the fact that some of the flowers have stamens as well as pistils, we shall more accurately describe the whole inflorescence (or mode of flowering) as *polygamo-diœcious*.

In Maple, as in Willow, the assistance of insects is necessary to ensure the transfer of the pollen to the stigma. The flowers are, therefore, entomophilous.

Fig. 76.

After fertilization, a *wing* is developed from the back of each of the two carpels, and the pedicels lengthen, so that as the fruit ripens it presents the familiar aspect of hanging clusters of double *samaras*, as these winged fruits are called (Fig. 76).

Fig. 74.—Twig of Red Maple bearing pistillate flowers.
Fig. 75.—Single pistillate flower. (Wood & Steele.)
Fig. 76.—Winged fruit or samara of Maple.

The Red Maple ripens its seeds early in the summer, and these, on falling, germinate immediately, so that by the autumn of the same year a vigorous young tree, a foot or more in height, is produced. The seeds will not germinate if kept over till the following spring.

The Sugar Maple, on the other hand, flowers later, the leaves and flowers appearing about the same time, and the seeds do not ripen till the fall. If kept slightly moist through the winter they will germinate the following spring.

76. The several species of common occurrence should be carefully studied and distinguished. Their characteristics are given in the proper place in Part II.

The Maples form a subordinate group of the natural Order *Sapindaceæ*. They are distinguished by the following characters:

1. *The flowers are dioecious (or polygamo-dioecious), and commonly unsymmetrical.*
2. *The ovary is two-lobed and two-celled, with two ovules in each cell, only one of which, however, is ripened.*
3. *The fruit is a double samara.*
4. *The leaves are opposite.*

77. From this type there are important deviations in other representatives of the Order. Horse-chestnut, for instance, while its flowers are unsymmetrical and somewhat irregular, as in the Maples, produces a *three-celled* ovary, with two ovules in each cell. But as in Maple, again, only one ovule in each cell forms a seed. The fruit, however, is not a samara, but a leathery pod which splits into three pieces at maturity, liberating the three large shining seeds.

Schedules descriptive of the Maple should be filled up, taking that of Willow as the model.

CHAPTER XI.

CHARACTERISTICS POSSESSED IN COMMON BY ALL THE PLANTS PREVIOUSLY EXAMINED—STRUCTURE OF THE SEED IN DICOTYLEDONS.

78. Before proceeding further in our examination of plants, we shall direct your attention to some characters of those already examined, which they all possess in common. The leaves of every one of them are *net-veined*. Some leaves, at least, of each of them have distinct petioles and blades. The parts of the flowers we found, as a general thing, to be in *fives*. In one or two instances they were in *fours*, that is four sepals, four petals, and so on.

Fig. 77. Fig. 78. Fig. 79.

79. Now, in addition to these resemblances, there are others which do not so immediately strike the eye, but which, nevertheless, are just as constant. One of these is to be found in the structure of the embryo. Take a Cucumber or a Pumpkin seed, and having soaked it for some time in water, remove the outer coat. The body of the seed will then readily split in two, except where the parts are joined at one end (Figs. 77, 78, 79). The thick lobes are called *cotyledons*, or *seed-leaves*, and as there are two, the embryo is *dicotyledonous*. The pointed end where the cotyledons

Figs. 77, 78, 79.—Different views of Pumpkin seed, showing radicle, cotyledons, and plumule.

are attached, and from which the root is developed, is called the *radicle*, a term meaning "little root." As it is strictly, however, a rudimentary *stem*, and not a root, the term *cauliele* would be better. Between the cotyledons, at the summit of the radicle, you will find a minute upward projection. This is a bud, which is known as the *plumule*. It developes into the stem.

80. If you treat a Pea or a Bean (Figs. 80, 81) in the same manner as the Cucumber seed, you will find it to be constructed on the same plan. The embryo of the Bean is dicotyledonous also. But you will observe that in these cases the embryo occupies the whole of the interior of the seed. In describing the seed of the Buttercup, it was pointed out that the embryo occupies but a very small space in the seed, the bulk of the latter consisting of *albumen*. Seeds like those of the Buttercup are therefore called *albuminous* seeds, while those of the Bean and Pea are *exalbuminous*. But, notwithstanding this difference in the structure of the seed, the *embryo* of the Buttercup, when examined under a strong magnifier, is found to be dicotyledonous like the others. In short, the dicotyledonous embryo is a character common to all the plants we have examined—common, as a rule, to all plants possessing the other characters enumerated above. From the general constancy of all these characters, plants possessing them are grouped together in a vast Class, called Dicotyledonous plants, or, shortly, **Dicotyledons.**

Fig. 80.

Fig. 81.

Figs. 80 and 81.—Seed of the Bean.

81. Besides the characters just mentioned, there is still another one of great importance which Dicotyledons possess in common. It is *the manner of growth of the stem.* In the Willow, and all our trees and shrubs without exception, there is an outer layer of bark on the stem, and the stem increases in thickness, year by year, by forming a new layer just inside the bark and *outside the old wood.* These stems are therefore called *exogenous*, that is, *outside growers.*

Now, in all Dicotyledonous plants, whether herbs, shrubs, or trees, the stem thickens in this manner, so that **Dicotyledons** are also **Exogens.**

CHAPTER XII.

EXAMINATION OF COMMON PLANTS CONTINUED—DOG'S-TOOTH VIOLET—TRILLIUM—IRIS—ORCHIS.

82. **Dog's-tooth Violet.** This plant (Fig. 82), which flowers in spring, may be pretty easily recognized by its peculiar blotched leaves. It may be found in rich, moist pasture lands and low copses. The name "Violet" is somewhat unfortunate, because the plant is not in any way related to the true Violets. To obtain a complete specimen requires some trouble, owing to the fact that the root is commonly six inches or so below the surface of the ground; you must therefore insert a spade or strong trowel sufficiently deep to avoid cutting or breaking the tender stem. Having cleared away the adhering earth, you will find that the roots proceed from what appears to be the

swollen end of the stem. This swollen mass is coated on the outside with thin scales. A section across the middle shows it to be more or less solid, with the stem growing

Fig. 82.

up through it from its base. It is, in fact, not easy to say how much of this stem-like growth is in reality stem,

Fig. 82.—Dog's-tooth Violet.

because it merges gradually into the scape, which bears the flower, and the petioles of the leaves, which sheath the scape. The swollen mass is called a *bulb*.

83. The leaves are two in number, gradually narrowing at the base into sheaths. If you hold one of them up to the light, you will observe that the veins do not, as in the leaves of the Dicotyledonous plants, form a network, but run only in one direction: namely, from end to end of the leaves. Such leaves are consequently called *straight-veined*.

Fig. 83.

84. In the flower there is no appearance of a green calyx. There are six yellow leaves, nearly alike, arranged in two sets, an outer and an inner, of three each. In such cases, we shall speak of the coloured leaves collectively as the *perianth*. If the leaves are free from each other we shall speak of the perianth as *polyphyllous*, but if they cohere we shall describe it as *gamophyllous*. Stripping off the leaves of the perianth, we find six stamens with long upright anthers which open along their outer edges. If the anthers be pulled off, the filaments will be found to terminate in long, sharp points.

The pistil (Fig. 83) has its three parts—ovary, style, and stigma—well marked. The stigma is evidently formed by the union of three into one. The ovary, when cut across, is seen to be three-celled (Fig. 84), and is, therefore, syncarpous.

Fig. 84.

Fig. 83.—Pistil of Dog's-tooth Violet.
Fig. 84.—Cross section of the pistil.

DOG'S-TOOTH VIOLET.

Organ.	No.	Cohesion.	Adhesion.	Remarks
Perianth.		Polyphyllous.	Inferior.	
Leaves.	6			
Stamens.	6	Hexandrous.	Hypogynous.	Filaments terminating in sharp points.
Pistil.		Syncarpous.	Superior.	
Carpels.	3			

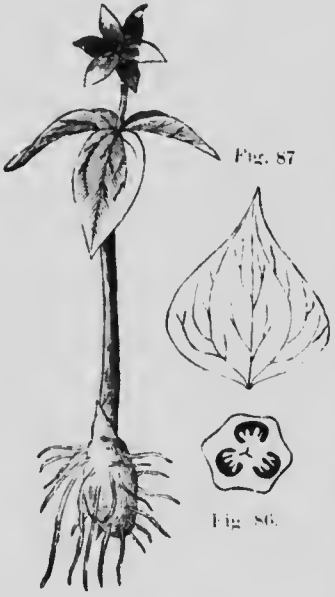

Fig. 85.

Fig. 87

Fig. 86.

85. **Trillium.** This plant (Fig. 85) may be found in flower about the same time as the one just described. The perianth of Trillium consists of six pieces in two sets, but in this case the three outer leaves are green, like a common calyx. The stamens are six in number. There are three styles, curving outwards, the whole of the inner side of each being stigmatic. The ovary (Fig. 86) is six-angled, and on being cut across is seen to be three-celled.

Fig. 85.—Trillium. Fig. 86.—Cross section of the pistil.
Fig. 87.—Net-veined leaf of Trillium.

86. Comparing this flower with that of Dog's-tooth Violet, we find the two to exhibit a striking resemblance in structure. But in one respect the plants are strikingly unlike: *the leaves of the Trillium are net-veined* (Fig. 87), as in the Exogens. From this circumstance we learn that we cannot altogether rely on the veining of the leaves as a *constant* characteristic of plants whose parts are not in fives.

TRILLIUM.

Organ.	No.	Cohesion.	Adhesion.	Remarks.
Perianth.		Polyphyllous.	Inferior.	Sepals persistent.
Sepals.	3			
Petals.	3			
Stamens.	6	Hexandrous.	Hypogynous.	
Pistil.		Syncarpous.	Superior.	The inner face of each style stigmatic.
Carpels.	3			
Leaves net-veined.				

87. The two plants just examined are types of the natural Order *Liliaceæ*. The distinguishing characters are as follows:

1. *The parts of the flower are almost invariably in sets of three, the perianth being of two such sets, and also the stamens. The flowers are therefore symmetrical; they are also regular.*
2. *The stamens are opposite the divisions of the perianth.*
3. *The ovary is nearly always 3-celled, and is superior.*

The representatives of this large Order are very numerous. From the gardens may be had lilies of various sorts, Asparagus, Star-of-Bethlehem, Tulip, Onion, Hyacinth, &c., whilst the fields and woods supply the Bellwort, Clintonia, Solomon's Seal, Smilacina, and others. As a rule the plants flower in spring and early summer.

88. **Iris.** For this lesson any variety of the common garden Flag will answer very well. In our marshes in early summer abundant specimens of a wild species may be obtained without much trouble, but the cultivated plants will probably be more accessible. Note first the fleshy underground stem or root-stock, with the fibrous roots below (Fig. 88). If you have a sufficient length of this root-stock you will notice the scars upon the older portions, showing where the leaves of former seasons have been sent up. The new buds expand into a crowded cluster of leaves, the shape and arrangement of which should be carefully observed. Cut the whole cluster across near the base, and the section will be as represented in Fig. 89, the section of each leaf being V-shaped,

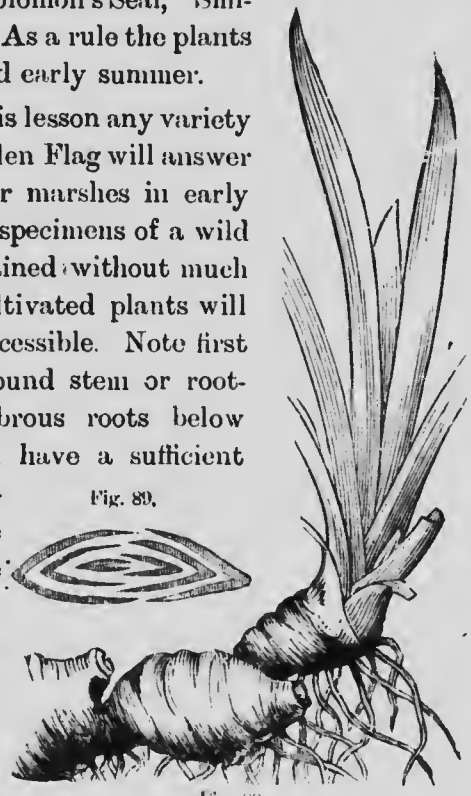

Fig. 89.

Fig. 88.

Fig. 88.—Root-stock and leaves of Iris. (Gray.)
Fig. 89.—Cross section of cluster of equitant leaves. (Gray.)

and *astride* the next one within. Leaves disposed in this manner are consequently said to be *equitant* (*eques*, a horseman). As the leaf rises upward it alters in shape, becoming flat and sword-like. Besides being equitant, these leaves, on account of their direction, are described as *vertical*. You will observe, also, that they are straight-veined.

From the centre of the cluster of leaves rises the scape which bears the flower. If your specimen has a flower-bud upon it, as is most likely, you will notice the way in which its leaves are folded. The mode of folding here exhibited is common to a great many flowers, and is described as *convolute*. In the full-blown flower the perianth will be found to consist of six pieces, in two distinct sets of three each; the outer three are considerably larger than the others, and are bent backwards or *reflexed*; the inner ones are erect. There are three stamens, each of them beneath and close against an over-arching body, the nature of which is not at first quite manifest. Cut away the perianth and the stamens, and you will then have left the three radiating coloured arches (Fig. 90), which will be seen to unite below into a slender column. You have also left what is apparently the swollen top of the scape. This, when cut across, is found to be a three-celled ovary, which is thus, of course, *inferior*. The slender column above is the style, and the

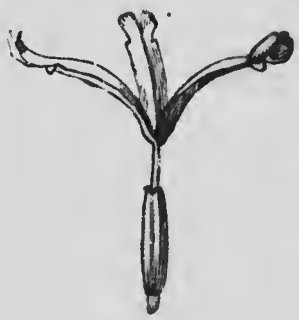

Fig. 90.

Fig. 90.—Pistil of Iris. (Wood and Steele.)

three petal-like arches are its branches. Immediately beneath the tip of each arch will be found a thin lip or plate, which is the stigma.

The anthers open *outwards* to discharge the pollen, and this fact, in addition to the peculiar situation of the anther as regards the stigma, makes it almost impossible that self-fertilization should take place in this flower. As was the case with other flowers already examined, the Iris is honey-bearing, and, besides, exceedingly showy. The nectar is situated in a cavity at the bottom of the flower, and cross-fertilization is accomplished by the aid of insects. It will be remembered that flowers thus fertilized are said to be entomophilous.

89. The Crocus and Gladiolus of the gardens and the Blue-eyed Grass of our low meadows may be examined and compared with the Iris. They are all types of the natural Order *Iridaceæ*, which you will observe differs from *Liliaceæ* chiefly in having flowers with only three stamens and an inferior ovary.

IRIS.

Organ.	No.	Cohesion.	Adhesion.	Remarks.
Perianth. *Leaves.*	6	Gamophyllous	Superior.	2 sets. Outer, large and reflexed; inner, erect.
Stamens.	3	Triandrous.	Perigynous.	Opposite the stigmas.
Pistil. *Carpels.*	3	Syncarpous.	Inferior.	Stigmas petal-like, arching over the extrorse anthers.

90. **Showy Orchis.** The flower of this plant (Figs. 91, 92) is provided with floral envelopes, all coloured like a corolla. As in Dog's-tooth Violet, we shall call them collectively the perianth, although they are not all alike. One of them projects forward in front of the flower,

Fig. 91.

forming the *lip*, and bears underneath it a long, hollow *spur* which, like the spurs of Columbine, is honey-bearing. The remaining five converge together, forming a kind of

Fig. 91.—Showy Orchis.

arch over the centre of the flower. Each flower springs from the axil of a leaf-like bract, and is apparently raised on a pedicel. What seems to be a pedicel, however, will, if cut across, prove to be the ovary, which in this case is inferior. Its situation is similar to the situation of the ovary in Willow-herb, and, as in that flower, so in this the calyx-tube adheres to the whole surface of the ovary, and the three outer divisions of the perianth are simply upward extensions of this tube. Notice the peculiar *twist* in the ovary. The effect of this twist is to turn the lip away from the scape, and so give it the appearance of being the lower petal instead of the *upper* one, as it really is.

Fig. 92.

91. The structure of the stamens and pistil remains to be examined, and a glance at the flower shows you that we have here something totally different from the common arrangement of these organs. In the axis of the flower, immediately behind the opening into the spur, there is an upward projection known as the *column*. The face of this column is the stigma; on each side of the stigma, and adhering to it, is an anther-cell. These cells, though separated by the column, constitute but a *single stamen*. The stamen, then, in this case is *united with the pistil*, a condition which is described as *gynandrous*.

Fig. 93.

92. If you have a flower in which the anther-cells are bursting open, you will see that the pollen does not issue from them in its usual dust-like form, but if you use the

Fig. 92.—Single flower of Orchis.
Fig. 93.—Pollen-mass of Orchis, greatly enlarged.

point of your needle carefully you may remove the contents of each cell *in a mass*. These pollen-masses are of the form shown in Fig. 93. The grains are kept together by a fine tissue or web, and the slender stalk, upon which each pollen-mass is raised, is attached by its lower end to a sticky disk on the front of the stigma just above the mouth of the spur. Insects, in their efforts to reach the honey, bring their heads in contact with these disks, and, when they fly away, carry the pollen-masses with them and deposit them on the stigma of the next flower visited. In fact, it is difficult to see how, without the aid of insects, flowers of this sort could be fertilized at all.

SHOWY ORCHIS.

Organ.	No.	Cohesion.	Adhesion.	Remarks.
Perianth. *Leaves.*	6	Gamophyllous	Superior.	
Stamens.	1	Monandrous.	Gynandrous.	Pollen-grains collected in masses.
Pistil. *Carpels.*	3	Syncarpous.	Inferior.	Ovary twisted.

93. Showy Orchis is a representative of the vast Order *Orchidaceæ*, the members of which are chiefly tropical. Some of our handsomest Canadian wild flowers, however, belong to it, such as the Lady's Slipper, the Rattlesnake Plantain, the beautiful little Calypso, and the Habenarias. Most of our orchids will be found in low and wet situations, and they flower rather early

in the year. The most remarkable characteristics of the Order are the gynandrous arrangement of the stamen or stamens, and the cohesion of the pollen-grains, though this latter peculiarity is exhibited also by other groups —notably, the Milkweeds.

CHAPTER XIII.

EXAMINATION OF SPADICEOUS PLANTS—INDIAN TURNIP—CALLA.

94. **Indian Turnip.** This plant may be easily met with in our woods in early summer. If you are not familiar with its appearance, the annexed cut (Fig. 94) will help you to recognize it. Procure several specimens: these will probably at first seem to you to be alike in every respect, but out of a number some are pretty sure to differ from the rest. Notice the bulb from which the stem springs. It differs from that of the Dog's-tooth Violet, and Lilies generally, in having a much larger solid part. It is called a *corm*. Between the pair of leaves you observe a curious striped sheath, having an arching, hood-like top, and enclosing an upright stalk, the top of which almost touches the hood (Fig. 95). Can this be a flower? It is certainly the only thing about the plant which at all resembles a flower, and yet how different it is from any we have hitherto examined! Carefully cut away the sheaths

from all your specimens. Most, and perhaps all, of them will then present an appearance like that in Fig. 96. If none of them be like Fig. 97 it will be well to gather a few more plants. We shall suppose, however,

Fig. 94.

that you have been fortunate in obtaining both kinds and will proceed with our examination. Take first a specimen corresponding with Fig. 96. Around the base of the column are compactly arranged many spherical green bodies, each tipped with a little point. Separate

Fig. 94.—Indian Turnip.

one of these from the rest and cut it across. It will be found to contain several ovules, and is, in fact, an ovary, the point at the top being a stigma. In the autumn a great change will have taken place in the appearance of plants like the one we are now examining. The arched hood will have disappeared, as also the long naked top of the column, whilst the part below, upon which we are now engaged, will have vastly increased in size, and become a compact ball of red berries. There can be no doubt, then, that we have here a structure analogous to that found in the Cucumber and the Willow, the fertile, or pistillate, flowers being clustered together separately. But in the Cucumber all the flowers were observed to be furnished with calyx and corolla, and in the Willow catkins, though floral envelopes were absent, each pair of stamens and each pistil was subtended by a bract. In the present plant there are no floral envelopes, nor does each pistil arise from a separate bract.

Fig. 95.

Fig. 96. Fig. 97.

95. But, you will now ask, what is this sheathing hood which we find wrapped about our column of pistils?

Fig. 95.—Spathe of Indian Turnip.
Fig. 96.—Fertile spadix of the same. Fig. 97.—Sterile spadix.

There is no doubt that we must look upon it as a *bract*, because from its base the flower-cluster springs. So that, whilst the flowers of Indian Turnip are, like those of Willow, imperfect and dioecious, the clusters differ in having but a single bract instead of a bract under each flower.

96. We must now examine one of the other specimens; and we shall have no difficulty in determining the nature of the bodies which, in this case, cover the base of the column. They are evidently stamens, and your magnifying-glass will show you that they consist mostly of anthers, the filaments being extremely short, and that some of the anthers are two-celled and some four-celled, all discharging their pollen through little holes at the top of the cells.

INDIAN TURNIP.

Organ.	No.	Cohesion.	Adhesion.
♂ Stamens.	1	Monandrous.	0
♀ Pistil.		Apocarpous.	0
Carpels.	1		

Flowers crowded on a spadix, and surrounded by a spathe.
Leaves net-veined.

97. The column upon which, in plants like Indian Turnip, the flowers are crowded, is known as a *spadix*, and the surrounding bract as a *spathe*.

You will observe that the leaves of this plant are *net-veined*, as we found them in the Trillium.

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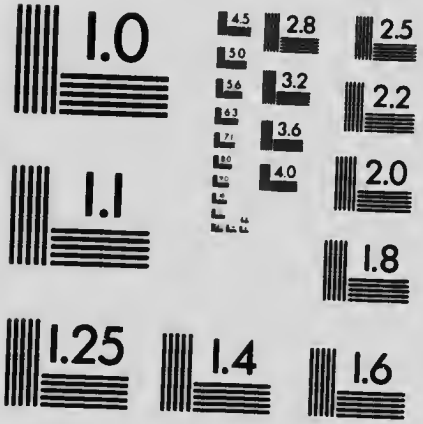

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98. **Marsh Calla.** This plant must be looked for in low, marshy grounds, where it will be found in flower generally in the month of June. With the knowledge which you have of the structure of Indian Turnip, you

Fig. 98.

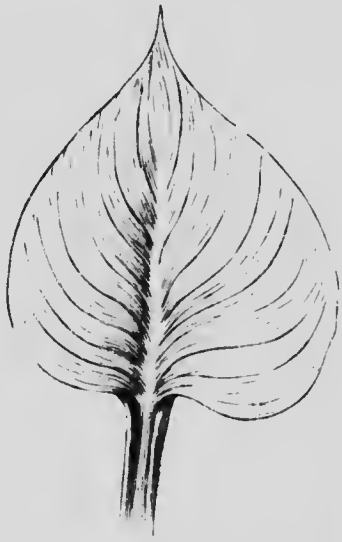


Fig. 99.

will hardly doubt that the Calla is closely related to it. You will easily recognize the spadix and the spathe (Fig. 98), though in the present instance the spadix bears flowers to the top, and the spathe is open instead of enclosing the column. Observe, however, that the veining of the leaf (Fig. 99) is different, that of Calla being straight, like the Dog's-Tooth Violet. There is also a difference in the flowers. Those of Indian Turnip were found to be dioecious, but the spadix, in the present

Fig. 98.—Spadix and spathe of Marsh Calla.
Fig. 99.—Leaf of the same.

case, bears both stamens and pistils, and most of the lower flowers, if not all, are *perfect*; sometimes the upper ones consist of stamens only. Fig. 100 shows one of the perfect flowers much enlarged. The stamens, it will be observed, have two-celled anthers, opening lengthwise.

Fig. 100

MARSH CALLA.

Organ.	No.	Cohesion.	Adhesion.
Perianth.		Wanting.	
Stamens.	6	Hexandrous.	Hypogynous.
Pistil.		Apocarpous.	Superior.
Carpels.	1		

99. These two plants, Indian Turnip and Marsh Calla, are representatives of the Order *Araceæ*. The characters which distinguish it are very well displayed in the two types we have selected for examination. The great feature is the aggregation of the flowers on a spadix. Generally, though not invariably, a spathe is also present. Among wild plants the Skunk Cabbage and Sweet Flag (the latter without a spathe) are common Araceous types, while the familiar green-house and window plant, known as the Calla-Lily, will serve very well for examination in winter. It may be added that the plants of this Order have a very acrid juice.

Fig. 100.—Perfect flower of Calla.

CHAPTER XIV.

EXAMINATION OF GLUMACEOUS PLANTS—TIMOTHY AND OTHER GRASSES.

100. **Timothy.** The top of a stalk of this well-known grass is cylindrical in shape, and upon examination will be found to consist of a vast number of similar pieces compactly arranged on very short pedicels about the stalk as an axis. Carefully separate one of these pieces from the rest, and if the grass has not yet come into flower the piece will present the appearance shown in Fig. 101. In this Fig. the three points in the middle are the protruding ends of stamens. The piece which you have separated is, in fact, a flower enclosed in a pair of bracts, and all the other pieces which go to make up the top are flowers also, and, except perhaps a few at the very summit of the spike, precisely similar to this one in their structure.

Fig. 101.

Fig. 102.

101. Fig. 102 is designed to help you in dissecting a flower which has attained a greater degree of development than the one shown in Fig. 101. Here the two bracts which enclose the flower have been drawn asunder. To these bracts the name *glumes* is applied. They are present in all plants of the Grass Family, and are often

Fig. 101.—Closed flower of Timothy.
Fig. 102.—Expanded flower of the same.

found enclosing several flowers instead of one as in Timothy. Inside the glumes will be found a second pair of minute chaff-like bracts, which are known as *palets* or *pales*. These enclose the flower proper.

102. The stamens are three in number, with the anthers fixed by the middle to the long slender filament. The anthers are therefore *versatile*. The styles are two in number, bearing long, feathery stigmas. The ovary contain a single ovule, and when ripe forms a seed-like *grain*, technically known as a *caryopsis*.

TIMOTHY.

Organ.	No.	Cohesion.	Adhesion.
Glumes.	2		
Palets.	2		
Stamens.	3	Triandrous.	Hypogynous.
Pistil.		Apocarpous.	Superior.
Carpels.	1		

103. It will be observed that the stalk of Timothy is hollow except at certain swollen knot-like joints. This peculiar stem of the Grasses is called a *culm*. Occasionally, however, it is not hollow. The leaves are long and narrow and straight-veined, and each of them at its base surrounds the culm with a *split sheath*. Observe also that at the

junction of the blade and the sheath there is a thin appendage which is called a *ligule*.

104. In many grass-flowers, besides the parts described above there will be found one or two minute scales below the pistil. These are known as *lodicules*, and are analogous to the perianth in ordinary flowers. They are, on account of their minuteness, very liable to be overlooked in a superficial examination.

Fig. 104. Fig. 103.

105. The immense Order *Gramineæ* (Grass Family) includes all our valuable grains, and is, on the whole, the most important and useful of all the Orders. Its representatives are to be found in every part of the world, and they vary in size from the stunted growths of the polar regions to the tree-like Bamboo of the tropics. Wheat, Indian Corn, Barley, Oats, Rye, Sugar-cane, Rice, are all Grasses, as well as the plants which make the verdure of our meadows and pastures. The flowers of all are very similar, but the Order is sub-divided on the basis of

Fig. 103.—Panicle of Red-top.

Fig. 104.—Single flower. (Gray.)

modifications which will be best understood by studying a few examples.

Fig. 105.

Fig. 106.

Fig. 107.

106. Procure specimens of the common Red-top, and first compare the general aspect of the flower-cluster (Fig. 103) with that of Timothy. Instead of a dense spike we have here a loose, open inflorescence; it is technically known as a *panicle*. You will see that it is an irregular branched raceme. As in Timothy, *each pair of glumes encloses but one flower* (Fig. 104), and we must observe that the term *spikelet*, so far as Grasses are concerned, is applied to the pair of glumes and whatever is contained in them, whether one flower, or many, as is often the case. In Red-top and Timothy, *the spikelets are 1-flowered*. Observe the very thin texture of the *palets*, and also that one of them (the lower, *i.e.*, the one farthest from the stalk) is nearly twice as large as the other, and is marked with three nerves.

Fig. 105.—Common Meadow-Grass.
Fig. 106.—Spikelet enlarged, showing the glumes at the base.
Fig. 107.—Single flower of same.

107. Next let us inspect a specimen of the Common Meadow-Grass. The inflorescence of this very common grass (Fig. 105) is a greenish panicle. The spikelets (Fig. 106) contain from three to five flowers, and are laterally compressed. The *glumes* are the lowest pair of scales, and they are generally shorter than the flowers within them. Observe the delicate whitish margin of the lower palet of each flower (Fig. 107), and the thin texture of the upper one. Count also, if you can, the five nerves on the lower palet, and observe the two teeth at the apex of the upper one. In this Grass the principal thing to notice is that *there are several flowers within each pair of glumes.*

108. A common pest in wheat-fields is the Grass known as Chess. It is comparatively easy of examination on account of the size of the spikelets (Fig. 108) and flowers. The spikelets form a spreading panicle, each of them being on a long, slender, nodding pedicel, and containing from eight to ten flowers. Of the two glumes at the base of each spikelet one is considerably larger than the other. The outer or lower palet of each flower is tipped with a bristle or *awn* (Fig. 109), while *the upper palet at length becomes attached to the groove of the oblong grain.* Observe that the *glumes* are not awned.

Fig. 108. Fig. 109.

109. The Couch Grass is another very common weed in cultivated grounds. In this Grass the spikelets are

Fig. 108.—Spikelet of Chess. Fig. 109.—Single flower. (Gray.)

sessile on opposite sides of the zigzag peduncle, so that the whole forms a spike. Each spikelet is four- to eight-flowered, and there is but one at each joint of the peduncle, the *side* of the spikelet being against the stalk. The glumes are nearly equal in size, and the lower palet of each flower closely resembles the glumes, but is sharp-pointed or awned. The grass spreads rapidly by running root-stocks, and is troublesome to eradicate.

110. Old-Witch Grass is to be found everywhere in sandy soil and in cultivated grounds. The leaves are very hairy, and the panicle very large, compound, and loose, the pedicels being extremely slender. Of the two glumes one is much larger than the other. Unless you are careful you will regard the spikelets as 1-flowered; observe, however, that in addition to the one manifestly perfect flower *there is an extra palet below*. This palet (which is very much like the larger glume) is a rudimentary or abortive second flower, and the spikelet may be described as 1½-flowered.

111. Barnyard Grass is a stout, coarse plant, common in manured soil. It is from one to four feet in height, and branches from the base. The spikelets form dense spikes, and these are crowded in a dense panicle which is rough with stiff hairs. The structure of the spikelets is much the same as in Old-Witch Grass, but the palet of the neutral flower is pointed with a rough awn or bristle.

112. In the common Foxtail the inflorescence is apparently a dense, bristly, cylindrical spike. In reality, however, it is a spiked panicle, the spikelets being much the same as in Barnyard Grass, but their *pedicels* are prolonged beyond them into awn-like bristles. In this

plant the bristles are in clusters and are barbed upwards. *The spikes are tawny-yellow in colour.*

113. These examples, if conscientiously studied with the aid of the plants themselves, will give you a good general idea of the kinds of variation which may be looked for in the Grasses. They may be said, roughly, to consist in the presence or absence of glumes, of awns, and of the upper palet; in the general aspect of the whole flower-cluster; in the number of flowers in the spikelets; and in the varying relative size of the glumes and of the palets.

114. The Order as a whole is distinguished by the following characters:

1. *The sheaths of the leaves are split on the side of the culm opposite the blade.*
2. *The separate flowers are enclosed in glumaceous bracts called palets*
3. *The perianth is represented by the lodicules.*
4. *The stamens are three in number, and the pistil is syncarpous (two carpels), with a one-celled ovary producing a single seed, which is always albuminous with the embryo on one side.*

CHAPTER XV

COMMON CHARACTERISTICS OF THE PLANTS JUST EXAMINED. STRUCTURE OF THE SEED IN MONOCOTYLEDONS.

115. It is now to be pointed out that the plants examined in the last three chapters, though differing in various particulars, yet have some characters common to all of them, just as the group ending with Maple was

found to be marked by characters possessed by all its members. The flowers of Dicotyledons were found to have their parts, as a rule, in fours or fives: those of our second group have them in *threes* or *sixes*, never in fives.

116. Again, the leaves of these plants are straight-veined, except in Trillium and Indian Turnip, which must be regarded as exceptional, and they do not as a rule exhibit the division into petiole and blade which was found to characterize the Exogens.

Fig. 110.

Fig. 112.

Fig. 111.

117. We shall now compare the structure of a grain of Indian Corn with that of the Cucumber or Pumpkin seed which we have already examined (page 59). It will facilitate our task if we select a grain from an ear which has been boiled. And, first of all, let us observe that the grain consists of something more than the seed. The grain is very much like the achene of the Buttercup, but differs in this respect, that the outer covering of the former is completely united with the seed-coat underneath it, whilst in the latter the true seed easily separates from its covering. Remove the coats of the grain, and what is left is a white, starchy-looking substance, having a yellowish body inserted in a hollow (Fig. 110) in the middle of one side. This latter body is the *embryo*, and may be easily removed. All the rest is *albumen*. Fig. 111 is a front view of the embryo, and Fig. 112 shows a vertical section of the same. The greater part of the

Figs. 110, 111, 112.—Sections of a grain of Indian Corn. (Gray.)

embryo consists of a *single cotyledon*. The radicle is seen near the base, and the plumule above. Compare an Oat (Fig. 113) with the grain of Corn and make out the corresponding parts. In all essential particulars they are alike.

118. Comparing the result of our observations with what we have already learned about the Cucumber seed, we find that whilst in the latter there are *two* cotyledons, in the present case there is but *one*, and this peculiarity is common to all the plants just examined, and to a vast number of others besides, which are consequently designated **Monocotyledonous** plants, or shortly **Monocotyledons.** The seeds of this great group may differ as to the presence or absence of albumen, just as the seeds of Dicotyledons do, but in the *number* of their cotyledons they are all alike. The Orchids, however, are very peculiar from having no cotyledons at all.

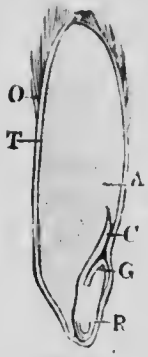


Fig. 113.

119. In addition to the points just mentioned, viz: the number of floral leaves, the veining of the foliage leaves, the usual absence of distinct petioles, and the single cotyledon, which characterize our second great group, there is still another, as constant as any of these, and that is, the mode of growth of the stem, which is quite at variance with that exhibited in Dicotyledonous plants. In the present group the increase in the thickness of the stem is accomplished not by the deposition of circle after circle of new wood outside the old, but by the production of new wood-fibres through the interior of the stem generally. These stems are therefore said to be

Fig. 113. — Vertical section of Oat grain; R, radicle; G, plumule; C, cotyledon; A, albumen (or endosperm); O, hairs; T, testa. (Themé.)

endogenous, and the plants composing the group are called **Endogens**, as well as **Monocotyledons**. The term Endogen, however, is used in quite a different sense by some recent botanists, and is discarded by them as a synonym for monocotyledon, as having been given originally under a misconception as to the true mode of growth of the wood in stems of this kind. We shall explain more fully the structure of exogenous and endogenous stems when we come to speak of the minute structure of plants in a subsequent chapter.

120. The typical flower of the Monocotyledons is that of the Lily; it consists of five whorls, two belonging to the perianth, two to the anthers, and one to the pistil. Other flowers of the group, as we have seen, exhibit departures from the type, chiefly in the suppression of whorls or parts of whorls. Thus in the Iris one whorl of stamens is suppressed. In this plant, also, the ovary is *inferior*. In the spadiceous plants the perianth is suppressed, and in the Grasses there may be suppression in all the whorls.

CHAPTER XVI.

EXAMINATION OF CONIFEROUS PLANTS—WHITE PINE—GROUND-HEMLOCK.

121. The cone-bearing trees are so striking and important a feature in Canadian vegetation that even an elementary work like the present would be incomplete without a notice of them. They form, besides, a very distinct group

of plants, intermediate in structure, as we shall see, between the groups upon which we have so far been

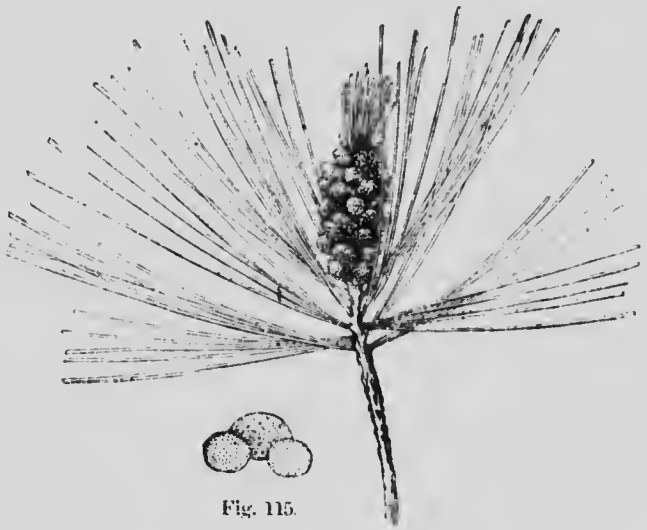


Fig. 115.

Fig. 114.

engaged and others to which we shall presently direct attention.

122. As perhaps the commonest Canadian type of the Coniferous Group, the White Pine first demands our attention. This noble tree, in its general aspect, is familiar to every one. It produces a straight trunk, which is continued upward year after year by the development of a strong terminal bud, the new branches of each year being developed from a circle of lateral buds formed behind the apex of the stem or old branch. The general aspect of the tree, therefore, unless it is a very old one, is that of a broad-based cone or spire. The leaves are straight

Fig. 114.—Leaves and cluster of staminate catkins of White Pine. (Wood and Steele.)

Fig. 115.—Pollen-grain of Pine. (Wood and Steele.)

needles, and are produced in clusters of five each. In the Red Pine, on the other hand, there are but two leaves in the cluster. Other species have bundles of three each. These leaves, as is well known, are *evergreen*, that is to say, they do not perish in the first autumn, but persist through the winter and until the new leaves of the following season are fully developed.

123. The flowers of the Pine must be looked for in spring just before the new leaves are put forth. They are monœcious or diœcious. The staminate flowers, consisting of a single stamen each, are produced around the bases of the new shoots, where they form dense clusters of small catkins (Fig. 114). Each anther is two-celled, and the pollen-grains (Fig. 115) are rather peculiar in shape, having, in fact, the appearance of three grains cohering together. The two outer portions, however, are only bladder-like developments of the outer coat *(extine)* of the real grain, which occupies the centre.

Fig. 116.

124. The pistillate or fertile flowers are aggregated together upon an elongated axis, forming in fact the well-known *cone* of the Pine (Fig. 116). The young cones will be found to occupy lateral positions on the branches; each of them is made up of many spirally arranged *scales*, each scale being in the axil of a bract (Fig. 117). At the base of each scale, on the inside, will be found two ovules turned downwards (Fig. 118). Observe that these ovules *are not enclosed in an ovary.* Because of this fact the group of plants of which the Pine is a type is said to be

Fig. 116.—Cone of Pine. (Wood and Steele.)

gymnospermous, that is, naked-seeded. All the plants previously examined, on the other hand, have their seeds enclosed in ovaries; hence they are all *angiospermous*. The scales of the cone are to be regarded as open carpellary leaves, and each of them, with its pair of ovules, constitutes a fertile flower. The pollen is carried by the wind directly to the micropyle of the ovule, there being no intervening stigma; but, as the quantity of pollen produced is immense, the chances of failure to reach the ovules are very slight. At the time of pollination, the air in a pine forest is full of pollen. The yellow scum often found on water after a summer shower is chiefly Pine pollen. After fertilization the ovules develope into seeds, and the scales of the cone, which are originally of rather soft texture, attain a woody consistency. This process of maturing, however, in the Pine takes considerable time. The cones do not ripen until the autumn of the second year, after flowering. At this time the scales diverge from the axis, and the seeds are allowed to escape, each of them being now furnished with a wing, which enables the wind more readily to waft it away.

Fig. 117.

Fig. 118.

The number of cotyledons in the embryo is variable, but is always more than two; sometimes there are as many as twelve.

Fig. 119.

The wood of the Gymnosperms is essentially like that of the Dicotyledons, and the stem thickens in the same way. Certain differences will be noticed in another place.

Fig. 117.—Single scale of Pine cone with its bract. (Wood and Steele.)
Fig. 118.—Inner side of the scale, showing the two naked ovules. (Wood and Steele.)
Fig. 119.—Staminate catkins of Ground Hemlock.

125. It will be interesting now to compare with the structure of the Pine that of another member of the same group—the Ground Hemlock, a low shrub common enough in our Canadian woods. This, like the Pine, is evergreen. The leaves, however, are not needle-shaped, but flat; and they are not clustered, but project singly from the sides of the stem.

126. The staminate flowers (Fig. 119) grow in small catkins at the ends of very short lateral shoots which bear about their bases many scale-like bracts. The stamens are somewhat different from those of Pine, being umbrella-shaped (peltate), and bearing from three to eight pollen-sacs upon the under surface. The fertile flowers are also at the extremities of short, scaly-bracted branches, but in this plant the flowers occur singly, and are not aggregated in cones. Fig. 120 shows a section of a fertile branch with its bracts and the single naked ovule at its extremity. Around the base of the ovule there is a fleshy ring or disk (shown in section at *a* in the figure). The pollen is conveyed by the wind directly to the micropyle, and after fertilization, and during the development of the seed, the fleshy ring upon which it rests grows upward so as to surround the seed and give the fruit a remarkable berry-like appearance (Fig. 121). This fleshy covering (which is

Fig. 120.

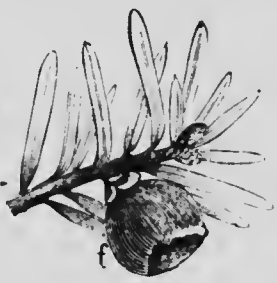


Fig. 121.

Fig. 120.—Section of fertile branch of Ground Hemlock; *s*, the apparently terminal ovule; *i*, its integument; *k*, the nucellus; *m*, the micropyle; *a a*, the rudiment of the aril, which lina ly surrounds the seed; *b b*, bracts. (Prantl).

Fig. 121.—The same with mature fruit, *f*. (Prantl).

bright red at maturity) is a good example of what is called an *aril*.

127. We find, then, that although there is at first sight little in common, apparently, between the cone of the Pine and the berry-like fruit of the Ground Hemlock (*Taxus baccata*), yet they both have the characteristic *naked ovules*.

128. Among our cone-bearing trees will readily be recognized the Arbor Vitæ (commonly called Cedar), the Larch or Tamarack, which, however, is not evergreen, and the various kinds of Spruce or Fir. The Juniper, also, belongs to this group, but is marked by the peculiarity that the few scales of the cone cohere together in ripening and become succulent, thus forming what looks like a berry.

129. To sum up the results of our observations upon plant-structure, we have found

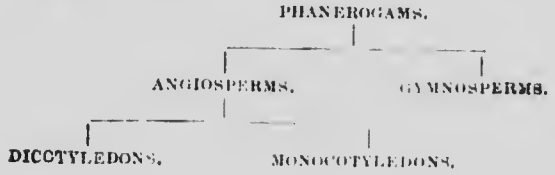
(1) That all the plants to which our attention has so far been directed *produce flowers;* they are all, therefore, flowering or *phanerogamous* plants, or, briefly, *phanerogams*.

(2) That in a large number of the plants there are ovaries enclosing the seeds. All such plants are grouped as [illegible]*osperms*.

(3) That in othe[illegible]he seeds are not enclosed in an ovary. Hence we have a group known as *gymnosperms*.

(4) That the angiosperms are either *dicotyledonous* or *monocotyledonous*.

These conclusions may be conveniently shown in a tabular form as follows:



CHAPTER XVII.

MORPHOLOGY OF ROOTS, STEMS, AND FOLIAGE-LEAVES OF PHANEROGAMS.

130. Before proceeding with the examination of other selected plants illustrative of other divisions of the vegetable kingdom, we shall present in a systematic way the more important facts in connection with the Phanerogams, dealing in turn with the organs of vegetation—the root, the stem, and the foliage-leaves—and then with the organs of reproduction as displayed in the flower. The various forms assumed by these organs, whether in different plants or in different parts of the same plant, will have our attention, as also their various modes of arrangement. We shall consider, also, rather more minutely than we have hitherto been able to do, the development of the seed from the ovule, the process of pollination and of fertilization, and the subsequent germination of the seed and development of the new plant. To this study of forms the name *Morphology* has been given. It need hardly be said that effective morphological work can only be accomplished by actual

contact with and inspection of the forms which are, for the time being, the objects of study. The young student must provide himself with specimens, and learn to associate the descriptive terms with the actual condition which the terms describe. Only in this way can this branch of botanical work be relieved of the element of drudgery, and made what it ought to be—a means of developing in a high degree those powers of observation with which the young are so exceptionally endowed. It is believed that with proper management even the more difficult technical terms, which are derived from Latin and Greek, and specially devised for botanical purposes, will be learned without extraordinary effort. It is the writer's experience that a term is insensibly acquired and almost indelibly impressed upon the mind *if there is first created the want of the term* to describe what is seen when some new form has been the subject of observation, and its peculiarities have been thoroughly grasped through the medium of the eye. With a good many of the terms there will be found no difficulty whatever, since they have the same meaning in their botanical applications as they have in their every-day use.

131. **The Root.** This organ is called the descending axis of the plant, from its tendency to grow downward into the soil from the very commencement of its development. Its chief use is to imbibe liquid nourishment, and transmit it to the stem, from which it is well distinguished by the presence of the root-cap (Fig. 122, *a*) and the absence of leaves. The absorbing surface of a young root or rootlet is largely increased by the development of *root-hairs*, the nature of which will be explained later on when we come to treat of trichomes or hair-like growths

generally. It must be mentioned here, also, that there are some exceptions to the general statement that roots do not produce buds. It is well known that new stems are sent up by the roots of Poplars and of Apple trees, for example, especially if the roots have been injured. These cases must be regarded as abnormal.

132. You will remember that in our examination of some common seeds, such as those of the Pumpkin and Bean (Figs. 77–81), we found at the junction of the cotyledons a small pointed projection called the *radicle*. Now, when such a seed is put into the ground, under favorable circumstances of warmth and moisture, it begins to grow or *germinate*, and the radicle, which in reality is a minute stem, not only lengthens, in most cases, so as to push the cotyledons upwards, but developes a *root* from its lower extremity. All seeds, in short, when they germinate, produce roots from the extremity of the radicle, and *in a direct line with it*, and roots so produced are called *primary roots*. In Monocotyledons the primary root is but very slightly developed, the fibrous roots characteristic of these plants bursting forth *from the sides* of the radicle at an early period of growth. In other plants the primary root either assumes the form of a distinct central axis larger than any of its branches, and called a *tap-root* (Fig. 123), examples of which are furnished by the Mallow, the Carrot, and the

Fig. 122.

Fig. 123.

Fig. 122.—Magnified tip of Hyacinth root; *a*, the root-cap. (Hooker)
Fig. 123.—Tap-root of Dandelion.

Bean, or it may *branch* at an early stage into numerous similar threads, and so form a fibrous root, as in Buttercup.

133. Tap-roots receive different names according to the particular shape they happen to assume. Thus, the Carrot (Fig. 124) is *conical*, because from a broad top it tapers gradually and regularly to a point. The Radish, being somewhat thicker at the middle than at either end, is *spindle-shaped*. The Turnip, and roots of similar shape, are *napiform* (*napus*, a turnip).

Fig. 124.

These fleshy tap-roots belong, as a rule, to biennial plants, and are designed as storehouses of food for the plant's use during its second year's growth. Occasionally fibrous roots also thicken in the same manner, as in the Peony, and then they are said to be *fascicled* or *clustered*. (Fig. 125).

Fig. 125.

134. But you must have observed that plants sometimes put forth roots in addition to those developed from the embryo of the seed. The Verbena of our gardens, for example, will take root at every joint if the stem be laid upon the ground (Fig. 126). The runners of the Strawberry take root at their extremities; and nothing is more familiar than that cuttings from various plants will make roots for themselves if put into proper soil, and supplied with warmth and moisture.

Fig. 124.—Tap-root of Carrot. Fig. 125.—Fascicled roots of Peony.

All such roots, not developed from the end of the radicle and in a straight line with it, are called *secondary* or *adventitious* roots. Under this head should, of course, be placed the fibrous roots of all Monocotyledonous plants, the true primary roots of which are but very feebly developed. So, also, all branches of primary roots should be regarded as adventitious. When such roots are developed from parts of the stem which are not in contact with the ground, they are *aerial*, as, for example, the roots developed from the lower joints of the stem of Indian Corn.

Fig. 126.

135. There are a few curious plants whose roots never reach the ground at all, and which depend altogether upon the air for food. These are called *epiphytes*. There are others whose roots penetrate the stems and roots of other living plants, and thus receive their nourishment as it were at second-hand. These are *parasitic* plants. The Dodder and Beech-drops, of Canadian woods, are well-known examples. Others, again, subsist upon decomposing animal or vegetable matter, and are hence known as *saprophytes*. Indian Pipe and Coral-root are good examples of saprophytic plants. Both parasites and saprophytes are usually destitute of green leaves,

Fig. 126.—Adventitious roots of Verbena.

being either pale or brownish. The Mistletoe, however, is a green parasite.

136. As to duration, roots (and, consequently, the plants themselves) are either *annual*, or *biennial*, or *perennial*. The plant is called an annual if its whole life, from the germination of the seed, is limited to one season. It is biennial if it flowers and ripens its seed in the second season. Between these two classes it is difficult to draw a sharp line, because, with proper care, some annuals may be induced to live for two years; and, on the other hand, some plants, as the Radish, which are properly biennial if the seed is sown in the fall, will flower and produce seed in one season if sown in the spring. Something, also, depends upon the climate in which the plant is grown, its life, in some cases, being prolonged in a more favourable situation. Perennials live on year after year, as is the case with all our shrubs and trees, and also with some herbaceous plants, as Peony and Dahlia, which only die down to the surface of the ground in the autumn.

137. **The Stem.** As the root is developed from the lower end of the radicle of the embryo, o the stem is developed from the upper end, but with this important difference, that a *bud* always precedes the formation of the stem or any part of it or its branches. If a bud, such as that of the Lilac, be picked to pieces, it will be found to consist mostly of minute leaves closely packed together on a short bit of stem. A bud, in fact, is only a special condition of the extremity of the stem, and is not to be regarded as an organ distinct from it. As the bud unfolds, the stem may lengthen so as to exhibit the internodes, or

it may remain short, in which case the expanded leaves form a cluster or rosette, as in Dandelion. The tender leaves of the bud are not uncommonly protected from the weather by coverings in the form of tough scales, with the additional safeguard sometimes of a wax-like coating on the surface of the latter, as seen in the conspicuous buds of the Horse-Chestnut, and the cap-like coverings of those of the Spruce.

138. Between the cotyledons of the Bean (Fig. 81), at the top of the radicle, we found a minute bud called the *plumule*. Out of this bud the first bit of stem is developed (leaving out of consideration the radicle itself), and during the subsequent growth of the plant, wherever a branch is to be formed or a main stem to be prolonged, there a bud will invariably be found. The branch buds are always in the axils of leaves, and so are called *axillary*, and it not uncommonly happens that several buds are found together in this situation.

139. *Adventitious* buds, however, are sometimes produced in plants like the Willow, particularly if the stem has been wounded. As already mentioned, they are also occasionally produced upon roots, as, for example, upon those of the Poplars.

The bud from which the main stem is developed, or a branch continued, is of course at the end of the stem or branch, and so is *terminal*.

141. **Branching** or **Ramification.** By a branch is meant an off-shoot similar in structure to the member from which it springs. Hence the side-shoots of roots are root-branches; so, also, the lateral out-growths of the stem which resemble the stem itself in structure are

stem-branches. It is found that the branching of stems proceeds upon two well defined plans.

142. *Monopodial Branching.* This system is distinguished by the circumstance that all the branches are the result the development of strictly lateral buds. In other words, there is invariably a terminal bud at the apex of the stem distinct from the lateral buds produced behind the apex. Of this system there are several

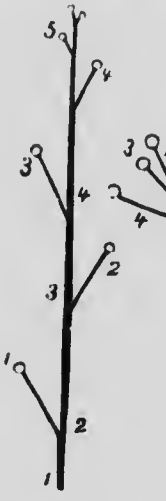


Fig. 130.

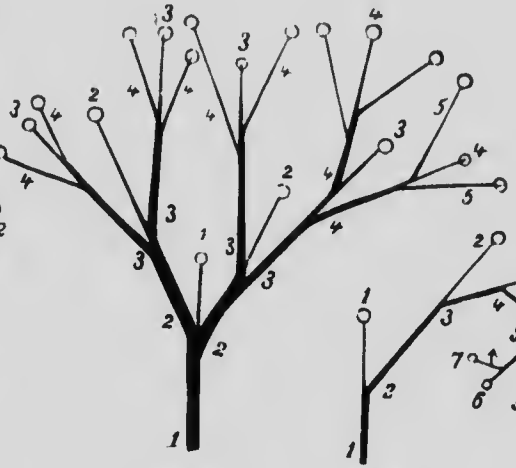


Fig. 127.

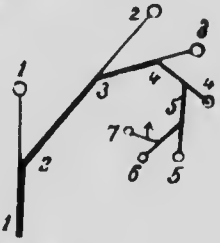


Fig. 128.

modifications. If the terminal bud develops regularly, as well as the lateral ones, it is clear that we shall have a straight and well-defined trunk, easily distinguished by its vigorous growth from the branches. The Pine or the Spruce is an excellent example of this effect.

Figs. 127, 128, 130.—Diagrams of various forms of monopodial branching. (Sachs.)

But if the terminal bud, though produced, ceases to grow, while the lateral buds are vigorously developed, as is well exhibited in the spring by the annual shoots of the Lilac, then it is clear that the branches will overtop the original stem, and the latter will finally become unrecognizable.

Fig. 129.

143. The Pine and the Spruce and similar forms are said to be *racemose* or *botryose*, and the Lilac, in the development of its annual shoots, is said to be *cymose*. Fig. 127 is a representation of the latter mode. Here 1 is the extremity of the main stem, but the terminal bud at that point has failed to grow, while two vigorous branches have been produced. The terminal buds of these branches (2 and 2), have in their turn failed, and the laterals immediately behind them have, as before, given rise to new shoots. This is the result, then, when both the lateral buds grow with equal vigour, and it is known as a *forked cyme*.

144. But sometimes one member of each pair of buds is developed far more strongly than the other. If the strong buds are developed in succession on the same side of the stem an effect will be produced like that represented in Fig. 128. This is known as a *helicoid* cyme. If, however, the strong buds are developed alternately on both sides of the stem, we get the form shown in Fig. 129, which is then called a *scorpioid* cyme. Not un-

Fig. 129. – Diagram to illustrate scorpioid cyme. (Sachs.)

commonly this latter form becomes straightened out, as in Fig. 130, so that the successive branches are in the same line, and look like a stem developed from the terminal bud. As the *foot* or support is not in this case the continuation of a single axis, but is made up of a number of successive branches superposed, these forms are said to be *sympodial*, the prefix in this term having the same significance as in "syncarpous" and the like, and implying that the foot is composed of several coherent parts. In these cases, then, we have a *sympodial monopodium*.

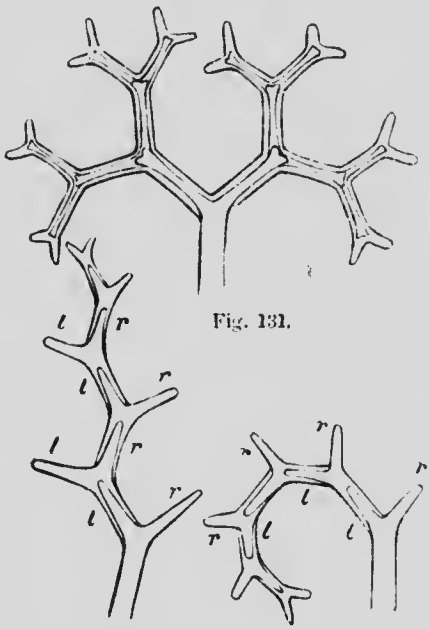


Fig. 131.

Fig. 133. Fig. 132.

145. *Dichotomous Branching.* In this system the growing point at the apex of the stem *divides into two new growing points*, both of which are, therefore, *terminal* and not lateral, as in the first mode. The growing points of the branches, in their turn, are each converted into two new ones, as shown in Fig. 131. As in the monopodial mode, there may be helicoid and scorpioid dichotomy, due to the superior development of the growing points on

Figs. 131, 132, and 133.—Diagrams to illustrate dichotomous branching. (Sachs.)

one side, or on alternate sides of the stem, as shown in Figs. 132 and 133. These forms are, of course, sympodial.

146. A comparison of Figs. 127 and 131 will show that there is a superficial resemblance between the forms. On this account the forked cyme is sometimes referred to as a *dichasium* or *false dichotomy*.

147. Dichotomous branching is rare, but occurs in the roots of Club-Mosses, and in Lichens. In the phanerogams, monopodial branching is the almost invariable rule. The flowering stems, which afford the best illustrations, will be referred to hereafter.

148. If you examine a few stems of plants at random, you will probably find some of them quite soft and easily compressible, while others will be firm and will resist compression. The stem of a Beech or a Currant is an instance of the latter kind, and any weed will serve to illustrate the former. The Beech and the Currant have *woody* stems, while the weeds are *herbaceous*. Between the Beech and the Currant the chief difference is in size. The Beech is a *tree*, the Currant a *shrub*. But you are not to suppose that there is a hard and fast line between shrubs and trees, or between herbs and shrubs. A series of plants could be constructed, commencing with an unquestionable herb and ending with an unquestionable tree, but embracing plants exhibiting such a gradual transition from herbs to shrubs and from shrubs to trees, that you could not say at what precise point in the series the changes occurred.

149. The forms assumed by stems above ground are numerous, and they are described mostly by terms in common use. For instance, if a stem is weak and trails

along the ground, it is *trailing* or *prostrate*; and if, as in the runners of the Strawberry, it takes root on the lower side, then it is *creeping*. Such a shoot as the runner of the Strawberry, which takes root at a distance from the parent plant, is commonly called a *stolon*.

Fig. 134.

150. Many weak stems raise themselves by clinging to any support that may happen to be within their reach. In some instances the stem itself winds round the support, assuming a spiral form, as in the Morning-Glory, the Hop, and the Bean, and is therefore distinguished as *twining*. In other cases the stem puts forth thread-like leafless branches called *tendrils* (Fig. 134), which grasp the support, as in the Virginia Creeper and the Grape. In the Pea, the end of the extended mid-rib of the leaf is transformed into a tendril (Fig. 135). Sometimes the leaf-stalks themselves serve the same purpose, as in the Clematis or Virgin's Bower. In these cases the stems are said to *climb*. Our Poison Ivy climbs over logs, &c., by the aid of its aerial roots.

Fig. 135.

The stems of wheat and grasses generally are known as

Fig. 134.—Leaf and tendril of Grape-vine.
Fig. 135.—Tendril of the Pea.

culms. They are jointed, and usually hollow except at the joints.

151. Besides the stems which grow above ground, there are varieties to be found below the surface. Pull up a Potato plant, and examine the underground portion (Fig. 136). It is not improbable that you will regard the whole as a mass of roots, but a very little trouble will undeceive you. Many of the fibres are unquestionably

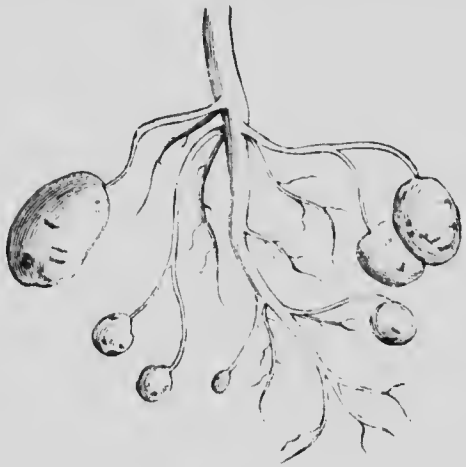


Fig. 136.

roots, but an inspection of those having potatoes at the ends of them will show you that they are quite different from those which have not. The former will be found to be furnished with little scales, answering to leaves, each with a minute bud in the axil; and the potatoes themselves exhibit buds of the same kind. The potato, in short, is only *the swollen end of an underground stem*. Such swollen extremities are known as *tubers*, whilst the

Fig. 136.—Tubers of the Potato.

underground stem is called a *root stock* or *rhizome*, and may almost always be distinguished from a true root by the presence of buds. The Solomon's Seal and Toothwort of Canadian woods, and the Canada Thistle, are common instances of plants producing these stems. Fig. 137 shows a rhizome.

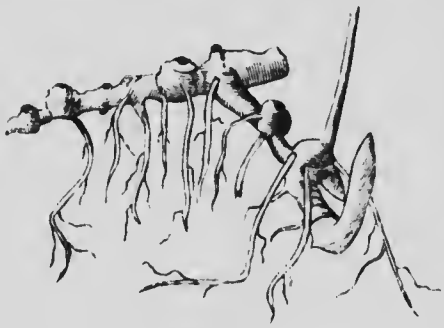


Fig. 137.

152. Take now an Onion, and compare it with a Potato. You will not find any such outside appearances upon the former as are presented by the latter. The Onion is smooth, and has no buds upon its surface. From the under side there spring roots, and this circumstance will probably suggest that the Onion must be a stem of some sort. Cut the Onion through from top to bottom (Fig. 138). It will then be seen to be made up of a number of coats. Strip off one or two, and observe that whilst they are somewhat fleshy where the Onion is broadest, they gradually become thinner towards the top. The long, green tubes which project from the top of the Onion during its growth are, in fact, the prolongations of these coats. But the tubes are the leaves of the plant itself. The mass of our Onion, therefore, consists

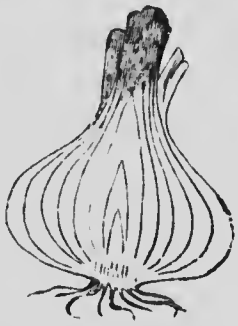


Fig. 138.

Fig. 137.—A rhizome.
Fig. 138.—Vertical section of bulb of the Onion.

of the *fleshy bases of the leaves*. But you will observe that at the bottom there is a rather flat, solid part upon which these coats or leaves are inserted, and which must consequently be a stem. Such a stem as this, with its fleshy leaves, is called a *bulb*. If the leaves form coats, as in the Onion, the bulb is *coated* or *tunicated;* if they do not, as in the Lilies (Fig. 139), it is *scaly*.

Fig. 139.

153. Tubers and bulbs, then, consist chiefly of masses of nourishing matter; but there is this difference, that in the latter the nourishment is contained in the fleshy leaves themselves, whilst in the former it forms a mass more or less distinct from the buds.

154. The thickened mass at the base of the stem of our Indian Turnip (Fig. 94) is more like a tuber than a bulb in its construction. It is called a *corm* or solid bulb. The Crocus and Gladiolus of the gardens are other examples. The chief difference between the corm and the ordinary bulb is in the relative space occupied by the stem or solid part. In the former it is very much greater than in the latter. The student should dissect specimens of Indian Turnip, Crocus, Tulip, Hyacinth, &c., when these differences will be readily apprehended.

155. In the axils of the leaves of the Tiger Lily are produced small, black, rounded bodies, which, on examination, prove to be of bulbous structure. They are, in fact, *bulblets*, and new plants may be grown from them.

156. **Foliage-Leaves.** These organs are usually more or less flat, and of a green colour. In some plants,

Fig. 139 - Bulb of a Lily.

however, they are extremely thick and succulent ; and in the case of parasites and saprophytes, such as Indian Pipe and Beech-drops, they are usually either white or brown, or of some colour other than green. The scaly leaves of underground stems are also, of course, destitute of colour. The green colour is due to the presence of granular particles of a substance called *chlorophyll*. It is formed, as a rule, only in those parts which are exposed to the action of sunlight, and it is intimately connected with the process of assimilating nutritious matter for the plant's use during growth. Further reference will be made to it later on.

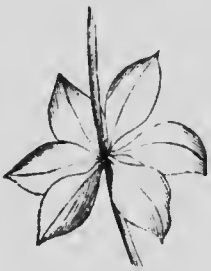


Fig. 140.

157. As a general thing, leaves are extended horizontally from the stem or branch, and turn one side towards the sky and the other towards the ground. But some leaves are *vertical*, and in the case of the common Iris (Figs. 88 and 89) each leaf is doubled lengthwise at the base, and *sits astride* the next one within. Such leaves are called *equitant*.

158. **Phyllotaxis** or **Leaf-Arrangement**. As to their arrangement on the stem, leaves are *alternate* when only one arises from each node (Fig. 3). If two are formed at each node, they are sure to be on opposite sides of the stem, and so are described as *opposite*. If, as in Mint and Maple, each pair of opposite leaves stands at right angles to the next pair above, then the arrangement is *decussate*. Sometimes there are several leaves at the same node, in which case they are *whorled* or *verticillate* (Fig. 140).

Fig. 140.—Whorled leaves of Galium.

159. Even if the leaves are placed single and apparently irregularly at intervals along the stem, it will be found on examination that their arrangement is governed by definite laws. Take, for instance, a branch of Poplar with a number of leaves upon it. Fix upon any one leaf near the lower end of the branch, and then from its point of insertion draw a line, *by the nearest way*, to the insertion of the next higher leaf, and from this to the next, and so on till you reach a leaf which is exactly over the first one. If the branch itself has not been twisted out of its normal shape, it will be found that the *sixth* leaf is always precisely over the first, the seventh over the second, the eighth over the third, and so on, and that the line joining the points of insertion of successive leaves forms a spiral round the stem. It will also be found that this spiral goes *twice* round the stem before passing through the sixth leaf. The sixth leaf, as standing exactly over the first, begins a new set, which lasts in a similar manner till we reach the eleventh. The leaves are therefore in sets or cycles of five each, and the phyllotaxis in this case is conveniently described by the fraction $\frac{2}{5}$, the denominator of which gives the number of leaves in the cycle, and the numerator the number of turns in the spiral.

160. Now, if through the insertions of the leaves which are vertically over each other—that is, through those numbered 1, 6, 11, 16, etc., and then through those numbered 2, 7, 12, 17, and so on—lines be drawn, it is evident we shall have five such vertical lines on the stem. These lines mark the *ranks* of leaves, or *orthostichies*. The number of orthostichies in any case always corresponds to the number of leaves in the cycle.

161. In the Elm, the phyllotaxis is much simpler. Here, starting with any given leaf, it will be found that the next one is exactly half way round the circumference of the stem, and the third one exactly over the first, and so on. So that the spiral completes the circuit in one turn, and the number of orthostichies is only two, the phyllotaxis being therefore described as $\frac{1}{2}$. The $\frac{1}{3}$ arrangement is also common. The Poplar, as we see, has a $\frac{2}{5}$ arrangement; this is extremely common.

162. If we set down these fractions in order, thus: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, it will be noticed that the sum of the first two numerators gives the third numerator; so also with the denominators. If we proceed to make other fractions in this way, the series would read $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, $\frac{8}{21}$, $\frac{13}{34}$, and these are, as it happens, the actual cases of phyllotaxy which we commonly meet with. The cone of the White Pine furnishes a very good exercise. In this case the scales (which, of course, are leaf-forms) have a $\frac{5}{13}$ arrangement.

163. The conclusion come to from a close examination of the incipient buds is, that the newer leaves are produced over the widest intervals between those next below. In short, the arrangement is that which secures to the leaves the most advantageous conditions for exposure to the light, and at the same time economizes space. As has been aptly said, the growth of the new leaves follows the "lines of least resistance."

164. When leaves are in whorls instead of in spirals, the members of any whorl stand over the spaces of the whorl below, as might be expected. As to leaves which are clustered or fascicled, like those of the Pine and Larch, it may be pointed out that the clustering is due simply to

the non-development of internodes. The clusters when carefully examined, show in some cases an alternate, and in others a whorled, arrangement.

165. As branches are produced in the axils of leaves, it is clear that the arrangement of branches will be the same as that of the leaves. It rarely happens, however, that all the buds develope into branches. Many of them fail, so that generally branches appear to have no very definite arrangement.

166. **Vernation** or **Præfoliation.** These terms have reference to the mode in which the new leaves are folded in the bud. Very commonly the leaf is simply doubled lengthwise, the upper side of the leaf within; then its vernation is said to be *conduplicate*. In the Maple and Mallow the folding is fan-like, and is described as *plaited*. In the Cherry the leaf is coiled in a single coil beginning with one edge: this is *convolute* vernation; but if the coiling is from both edges to the mid rib, it is said to be *involute;* if both edges are rolled backward, it is *revolute*. The vernation is *circinate* when the leaf is coiled from the tip, as in Ferns.

167. **Forms of Foliage-Leaves.** Leaves present an almost endless variety in their forms, and accuracy in describing any given leaf depends a good deal upon the ingenuity of the student in selecting and combining terms. The chief terms in use will be given here.

Compare a leaf of the Round-leaved Mallow with one of Red Clover (Figs. 141, 142). Each of them is furnished with a long petiole and a pair of stipules. In the blade, however, there is a difference. The blade of the former consists of a *single piece;* that of the latter

is in three separate pieces, each of which is called a *leaflet*, but all of which, taken collectively, constitute the blade of the *leaf*. The leaf of the Mallow is **simple**; that of the Clover is **compound**. Between the simple and the compound form there is every possible shade of gradation. In the Mallow leaf the *lobes* are not very clearly defined. In the Maple (Fig. 143) they are well

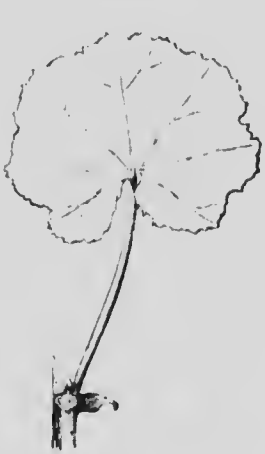


Fig. 141.

Fig. 142

marked. In other cases, again, the lobes are so nearly separate that the leaves appear at first sight to be really compound.

168. You will remember that in our examinations of dicotyledonous plants, we found the leaves to be invariably net-veined. But, though they have this general character in common, they differ considerably in the details of their veining, or **venation**, as it is called. The two leaves employed as illustrations in the last section will

Fig. 141. – Simple palmately-veined leaf of Mallow.
Fig. 142. – Compound leaf of Clover.

serve to illustrate our meaning here. In the Mallow, there are several ribs of about the same size, radiating from the end of the petiole, something like the spread-out fingers of a hand. The veining in this case is therefore described as *digitate*, or *radiate*, or *palmate*. The *leaflet* of the Clover, on the other hand, is divided exactly in the middle by a single rib (the *mid-rib*), and from this the veins are given off on each side, so that the veining, on the whole, presents the appearance of a feather, and is, therefore, described as *pinnate* (*penna*, a feather).

Fig. 143.

169. Both simple and compound leaves exhibit these two modes of venation. Of simple pinnately-veined leaves, the Beech, Mullein, and Willow supply familiar instances. The Mallow, Maple, Grape, Currant, and Gooseberry have simple radiate-veined leaves. Sweet-Brier (Fig. 13), Mountain Ash, and Rose have compound pinnate leaves, whilst the Box or Virginia-Creeper (Fig. 144), Horse-Chest-nut, and Hemp are compound digitate.

Fig. 144.

Fig. 143.—Palmately-lobed leaf of Maple.

Fig. 144.—Palmate leaf of Virginia Creeper.

As has already been pointed out, the leaves of Monocotyledonous plants are almost invariably straight-veined.

170. In addition to the venation, the description of a

Fig. 145.

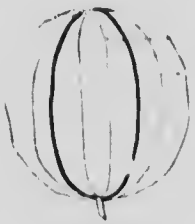


Fig. 146.

simple leaf includes particulars concerning: (1) the **general outline,** (2) the **edge** or **margin,** (3) the **point** or **apex,** (4) the **base.**

171. **Outline.** As to outline, it will be convenient to consider first the forms assumed by leaves without lobes,

Fig. 147.

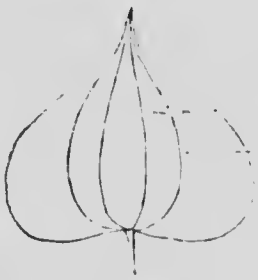


Fig. 148.

and whose margins are therefore more or less continuous. Such leaves are of three sorts, viz.: those in which both ends of the leaf are alike, those in which the apex is

Figs. 145 to 148.—Various forms of foliage-leaves.

narrower than the base, and those in which the apex is broader than the base.

172. In the first of these three classes it is evident that any variation in the outline will depend altogether on the

Fig. 152. Fig. 149. Fig. 150 Fig. 151.

relation between [illegible], and the breadth of the leaf. When the leaf is extremely narrow in comparison with its length, as in the Pine, it is *acicular* or *needle-shaped* (Fig. 145). As the width increases, we pass through the forms known as *linear*, *oblong*, *oval*, and finally *orbicular*, in which the width and length are nearly or quite equal (Fig. 146).

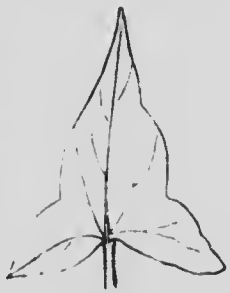


Fig. 154.

173. In the second class the different forms arise from the varying width of the base of the leaf, and we thus have *subulate* or *awl-shaped* (Fig. 147), *lanceolate*, *ovate*, and *deltoid* leaves (Fig. 148).

Figs. 149 to 154. Various forms of foliage leaves.

174. In the third class, as the apex expands, we have the forms *spathulate* (Fig. 149), *oblanceolate*—that is, the reverse of lanceolate (Fig. 150), and *obovate* (Fig. 151).

175. In leaves of the second kind we frequently find the base indented, and then the leaf is *cordate* or *heart-*

Fig. 155.

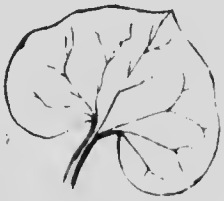


Fig. 156.

Fig. 157.

shaped (Fig. 152). The reverse of this—that is, when the indentation is at the apex—is *obcordate* (Fig. 153). The *hastate* or spear-shaped (Fig. 154), *sagittate* or arrow-shaped (Fig. 155), and *reniform* or kidney-shaped (Fig. 156) forms are modifications of the second class, and will be readily understood from the annexed figures.

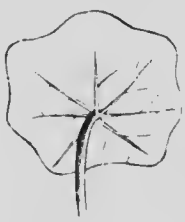


Fig. 158.

If the petiole is attached to any part of the under surface of the leaf, instead of to the edge, the leaf is *peltate* (shield-shaped) (Fig. 158).

176. Leaves which are lobed are usually described by stating whether they are palmately or pinnately veined; and

Figs. 155 to 158.—Various forms of foliage-leaves.

if the former, the number of lobes is generally given. If the leaves are very deeply cut, they are said to be *palmatifid* or *pinnatifid*, according to the veining (Fig. 159). If the leaf is pinnatifid and the lobes point backwards towards the base, as in Dandelion, the leaf is said to be *runcinate*. If the leaf is palmately lobed, and the lobes at the base are themselves lobed, the leaf is *pedate* (Fig. 160), because it looks something like a bird's foot. If the lobes of a pinnatifid leaf are themselves lobed, the leaf is *bipinnatifid*. If the leaf is cut up into fine segments, as in Dicentra, it is said to be *multifid*.

Fig. 159.

177. **Apex.** The principal forms of the apex are the *mucronate* (Fig. 157), when the leaf is tipped with a sharp point, as though the mid-rib were projecting beyond the blade; *cuspidate*, when the leaf ends abruptly in a very short, but distinctly tapering, point (Fig. 161); *acute*, or sharp; and *obtuse*, or blunt.

Fig. 160.

Fig. 161

It may happen that the apex does not end in a point of any kind. If it looks as though the end had been cut on square, it is *truncate*. If the end is slightly notched, but not sufficiently so to warrant the description obcordate, it is *emarginate*.

178. **Margin.** If the margin is not indented in any way, it is said to be *entire*. If it has sharp teeth, *pointing*

Figs. 159 to 161.—Various forms of foliage-leaves.

in the direction of the apex, it is *serrate*, and will be coarsely or finely serrate, according to the size of the teeth. Sometimes the edges of large teeth are themselves finely serrated, and in that case the leaf is *doubly serrate* (Fig. 162). If the teeth point *outwards*, that is, if the two edges of each tooth are of the same length, the leaf is *dentate*; but if the teeth, instead of being sharp, are *rounded*, the leaf is *crenate* (Fig. 163). The term *wavy* explains itself.

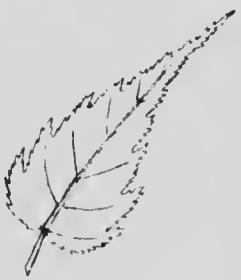


Fig. 162.

179. **Base.** There are two or three peculiar modifications of the bases of simple sessile leaves which are of considerable importance in distinguishing plants. Sometimes a pair of lobes project backwards and cohere on the other side of the stem, so that the stem appears to pass through the leaf. This is the case in our common Bellwort, the leaves of which are accordingly described as *perfoliate* (Fig. 164). Sometimes two opposite sessile leaves grow together at the base and clasp the stem, as in the upper leaves of Honeysuckle, in the Triosteum, and in one of our species of Eupatorium. Such leaves are said to be *connate* or *connate-perfoliate* (Fig. 165). In one of our Everlastings the margin of the leaf is continued on each side below the point of insertion, and the lobes grow fast to the sides of the stem, giving rise to what is called the *decurrent* form (Fig. 166).

Fig. 163

Fig. 164.

Figs. 162 to 164.—Various forms of foliage-leaves.

The terms by which simple leaves are described are applicable also to the leaflets of compound leaves, to the sepals and petals of flowers, and, in short, to any flat forms.

Fig. 165.

Fig. 166.

180. We have already explained that compound leaves are of two forms, *pinnate* and *palmate*. In the former the leaflets are arranged on each side of the mid-rib. There may be a leaflet at the end, in which case the leaf is *odd-pinnate;* or the terminal leaflet may be wanting, and then the leaf is

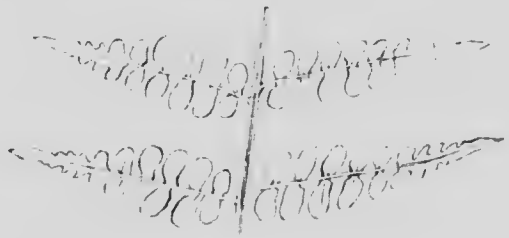


Fig. 167.

abruptly pinnate. In the Pea, the leaf is pinnate and terminates in a *tendril* (Fig. 135). Very frequently the primary divisions of a pinnate leaf are themselves pinnate, and the whole leaf is then *twice-pinnate* (Fig. 167). 51

Figs. 165 to 167. Various forms of foliage-leaves.

the sub-division is continued through another stage, the leaf is *thrice-pinnate*, and so on. Sometimes, as in the leaves of the Tomato, very small leaflets are found between the larger ones, and this form is described as *interruptedly pinnate* (Fig. 168).

Fig. 68.

In the palmate or digitate forms the leaflets spread out from the end of the petiole, and, in describing them, it is usual to mention the number of divisions. If there are three, the leaf is *tri-foliolate*; if there are five, it is *quinque-foliolate*.

181. In the examination of the Mallow we found a couple of small leaf-like attachments on the petiole of each leaf, just at the junction with the stem. To these the name *stipules* was given. Leaves which have not these appendages are *exstipulate*.

Fig. 169.

182. Besides the characters of leaves mentioned above, there remain a few others to be noticed. With regard to their **surface**, leaves present every gradation from perfect smoothness, as in Wintergreen, to extreme roughness or woolliness, as in the Mullein. If hairs are entirely absent

Fig. 168.—Interruptedly pinnate leaf.
Fig. 169.—Leaf of Pitcher-Plant.

the leaf is *glabrous*; if present, the degree of hairiness is described by an appropriate adverb; if the leaf is completely covered, it is *villous* or *villose*; and if the hairs are on the margin only, as in our Clintonia, it is *ciliate*. Some leaves, like those of the Cabbage, have a kind of bloom on the surface, which may be rubbed off with the fingers; this condition is described as *glaucous*.

183. A few plants have **anomalous leaves**. Those of the Onion are *fistulose*. The Pitcher-Plant of our northern swamps has very curious leaves (Fig. 169), apparently formed by the turning in and cohesion of the outer edges of an ordinary leaf so as to form a tube, closed except at the top, armed on the inner surface with bristles pointing downwards the base of the leaf.

184. Finally, as leaves present an almost infinite variety in their forms, it will often be necessary in describing them to combine the terms explained above. For instance, a leaf may not be exactly linear, nor exactly lance-shaped, but may approximate to both forms. In such a case the leaf is described as *lanci-linear*, and so with other forms.

The following form of schedule may be used with advantage in writing out descriptions of leaves. Two leaves — one of Maple and one of Sweet Brier — are described by way of illustration. If a leaf is compound, the particulars as to outline, margin, apex, base, and surface will have reference to the leaflets.

The exercise-book prepared to accompany this work contains a supply of blank schedules for leaf-description, with space for drawings.

LEAF SCHEDULE.

Leaf of	Maple.	Sweet Briar.
1. Position.	Cauline.	Cauline.
2. Arrangement.	Opposite.	Alternate.
3. Insertion.	Petiolate.	Petiolate.
4. Stipulation.	Exstipulate.	Stipulate.
5. Division.	Simple.	Odd pinnate, 7 leaflets.
6. Venation.	Palmate.	
7. Outline.		Roundish or oval.
8. Margin.	Deeply lobed.	Doubly serrate.
9. Apex.	Pointed.	Acute.
10. Base.	Cordate	Hardly indented.
11. Surface	Glabrous above; whitish beneath.	Downy above; covered with glands beneath.

CHAPTER XVIII.

MORPHOLOGY OF FLOWER-LEAVES INFLORESCENCE—THE CALYX—THE COROLLA—THE STAMENS THE PISTIL THE FRUIT—THE SEED GERMINATION.

185. From an examination of the various forms presented by foliage-leaves, we proceed now to those of the floral ones, and we shall first consider the chief modifications in the *arrangement of flowers as a whole*, to which the term **inflorescence** is applied.

As the organs of which flowers are made up are strictly leaf-forms, the special stalks upon which they are produced (peduncles and pedicels) are true branches, and their development is in strict accordance with the principles enunciated in sections 141–144. As there stated, the almost invariable mode of branching in phanerogams is monopodial, either after the *botryose* type or after the *cymose* type. So inflorescence is found to proceed upon one or other of these two plans.

186. To understand these let us recur to our specimens of Shepherd's Purse and Buttercup. You will remember that in the former the peduncle continues to lengthen as long as the summer lasts, and new flowers continue to be produced at the upper end. Observe, however, that every one of the flowers is produced on the side of the stem, that as the stem lengthens new lateral buds appear, and that *there is no flower on the end of the stem*. The production of the flowering branches (pedicels) and the continuation of the main axis are, in fact, exactly analogous to the growth of the Spruce, as explained in section 142.

You will easily understand, then, that the production of flowers in such a plant is only limited by the close of the season or by the exhaustion of the plant. Such inflorescence is, therefore, called **indefinite,** or **indeterminate,** or **axillary.** It is sometimes also called *centripetal*, because if the flowers happen to be in a close cluster, as are the upper ones in Shepherd's Purse, the order of development is from the outside *towards the centre*.

187. If you now look at your Buttercup you will be at once struck with the difference of plan exhibited. The main axis or stem has *a flower on the end of it*, and its further growth is therefore checked. And so, in like manner, from the top downwards, the growth of the branches is checked by the production of flowers at their extremities. The mode of inflorescence here displayed is **definite,** or **determinate,** or **terminal.** It is also called *centrifugal*, because the development of the flowers is the reverse of that exhibited in the first mode. The upper, or, in the case of close clusters, the *central*, flowers open first.

188. In either mode the flowers are said to be *solitary*, if (1) single flowers are produced in the axils of the ordinary foliage-leaves (botryose), or (2) if a single flower terminates the stem, as in Tulip (terminal).

189. Of **indeterminate** or **botryose inflorescence** there are several varieties. In Shepherd's Purse we have an instance of the *raceme*, which may be described as a cluster in which each flower is supported on a lateral pedicel of its own, usually in the axil of a bract. If the pedicels are absent and the flowers consequently

sessile in the axils, the cluster becomes a *spike*, of which the common Plantain and the Mullein furnish good examples. The *catkins* of the Willow (Figs. 68 and 69) and Birch and the *spadix* of the Indian Turnip (Figs. 96 and 97) are also spikes, the former having scaly bracts and the latter a fleshy axis. If you suppose the

Fig. 170

Fig. 171.

internodes of a spike to be suppressed so that the flowers are densely crowded, you will have a *head*, of which Clover and Button-bush supply instances. If the lower pedicels of a raceme are considerably longer than the

Fig. 170. Plan of the simple corymb.
Fig. 171.—Compound raceme. (Gray.)

upper ones, so that all the blossoms are nearly on the same level, the cluster is a *corymb* (Fig. 170). If the flowers in a head were elevated on separate pedicels of the same length, radiating like the ribs of an umbrella, we should have an *umbel*, of which the flowers of Geranium and Parsnip (Fig. 51) are examples. A raceme will be *compound* (Fig. 171) if, instead of a solitary flower, there is a *raceme in each axil*, and a similar remark will apply in the case of the spike, the corymb, and the umbel.

190. The inflorescence of most Grasses is what is called a *panicle*. This is a compound form, and is

Fig. 172.

usually a kind of raceme having its primary divisions branched in some irregular manner.

191. Of **determinate inflorescence** the chief modification is the *cyme*. This is a rather flat-topped

Fig. 172. A cyme. (Gray.)

cluster, having something the appearance of a compound corymb, but easily distinguished by this peculiarity: that the *central blossom opens first*, then those at the ends of the first set of branches of the cluster, then those on the secondary branches, and so on until the outer buds are reached. The Elder, Dogwood, and St. John's Wort furnish good examples of the cymose structure. Fig. 172 shows a loose, open cyme.

Helicoid and *Scorpioid* cymes have already been described in section 114.

192. Besides the two distinct modes of inflorescence just described, forms are met with which exhibit the peculiarities of both modes. For example, the flower-cluster of the Lilac is botryose or racemose as to the production of its primary branches, but the development of the flowers on the branches is according to the cymose type. On the other hand it sometimes happens, in many of the Composites for example, that the primary branches are cymose while the secondary are botryose. In the Lilac and the Horse-Chestnut the compact mixed cluster is called a *thyrse*. Panicles, also, instead of being altogether botryose, may be of a similar mixed character.

193. In many plants of the Mint Family the flowers appear to form dense whorls at intervals about the stem. Each of these whorls, when analysed, is found to consist of two cymose clusters on opposite sides of the stem. Such whorls are, therefore, mixed, and are often spoken of as *verticillasters*.

194. It has already been pointed out that cauline leaves tend to diminish in size towards the upper part of the stem where the flowers are found. Such reduced

leaves, containing flowers in their axils, are called *bracts*. In the case of compound flower-clusters this term is limited to the leaves on the peduncle or main stem, the term *bractlet* being then applied to those occurring on the pedicels or subordinate stems. In the case of the *umbel* and the *head*, it generally happens that a *circle* of bracts surrounds the base of the cluster. They are then called, collectively, an *involucre*, and in the case of compound clusters a circle of bractlets is called an *involucel*. Bracts are often so minute as to be reduced to mere *scales*. On the other hand they are occasionally very conspicuous and showy, as, for instance, in the four white bracts resembling a flower in the Bunchberry. From our definition it will be evident, also, that the *spathe* surrounding the spadix in Indian Turnip is merely a bract.

195. *Floral symmetry.* Before dealing with the morphology of the separate leaf-forms which go to make up the flower, a few words are necessary in regard to the relations of the different sets of floral organs, both as to number and as to position. The leaves which constitute the flower are arranged about the axis either in whorls, when the flowers are said to be *cyclic*; or in spirals, after the manner of most foliage-leaves, in which case the flowers are *acyclic*. Occasionally the outer sets (the perianth) are in whorls, while the stamens are spirally arranged: then the flowers are said to be *hemicyclic*. The spiral arrangement prevails, as a rule, where the floral organs are very numerous, as, for instance, in the Water Lily and in Buttercup; though Columbine, with very numerous stamens, has cyclic flowers.

196. In cyclic flowers, whilst there is usually one whorl each of sepals, petals, and carpels, there are not unfrequently two whorls of stamens. If each whorl is made up of the same number of members the flower is *isomerous*, and will, at the same time, be *monomerous*, *dimerous*, *trimerous*, *tetramerous*, or *pentamerous*, according as each whorl contains one, two, three, four, or five members. If the numbers of the members in the whorls do not correspond, the flowers are *heteromerous*.

197. The relations of the whorls to each other in any particular case may be very conveniently exhibited by a diagram. Fig. 173, for example, shows the plan of a Lily. The dot at the top of the figure represents the position of the axis of the plant, and should always be shown in a floral diagram. The side of the flower towards the stem is the *posterior* side, the opposite one being *anterior*, and a plane passing through the centre of the flower and also through the stem or axis is called the *median plane*. We have in the flower of the Lily an outer whorl of three members; then alternately with these (and this is the usual plan in cyclic flowers) a second whorl of three members; then the outer whorl of stamens, also three in number; then the three inner stamens; and, finally, the three carpels.

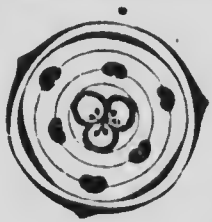


Fig. 173.

198. The composition of this flower may also be expressed by a formula, as follows: K_3, C_3, A_{3+3}, $(G^{(3)})$, where K stands for calyx, C for corolla, A for anthers, G for gynœcium. The brackets enclosing the figure

Fig. 173.—Diagram of Lily flower. (Prantl.)

which follows G show the carpels to be united, and the placing of the figure *above* the short line indicates that the ovary is superior; if inferior, the figure would be written below the line. Fig. 174 shows the plan of a Grass-flower. Here parts which are suppressed, and the position of which can in general be easily inferred from that of those which are present, are represented by dots. The formula would be: K_0, C_2, A_{3+0}, $G^{(2)}$.

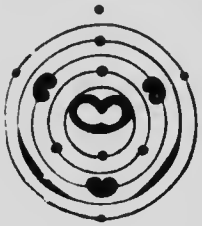


Fig. 174.

199. The gynœcium is very frequently made up of fewer members (carpels) than the other whorls, and in all such cases the position of the carpels is more or less irregular.

200. Fig. 175 gives the plan of Shepherd's Purse. This shows the four sepals to be in two whorls of two sepals each; the four petals, however, are arranged alternately with the four sepals, as if the latter were all in one whorl; the position of the stamens indicates that the *two* posterior ones, as well as the two anterior ones, occupy the place of single stamens, and have, therefore, probably arisen from the early division of single stamens into pairs. The formula would be: K_{2+2}, C_4, A_{2+2^2}, $G^{(2)}$; the expression 2^2 indicating the reduplication of the inner stamens.

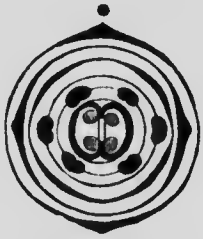


Fig. 175.

201. If there is no clear distinction between the calyx and corolla, the letter P (for perianth) may be used to include both; and, finally, if the members of any whorl

Fig. 174.—Diagram of a Grass-flower. (Prantl.)
Fig. 175.—Diagram of flower of Shepherd's Purse. (Prantl.)

stand *opposite* those of the one exterior to it, a vertical line may be placed between the symbols, thus: $C_5 \mid A_5$.

202. Other methods of indicating symbolically the relations of the parts of the flower are in vogue; the one just given is recommended by Prantl, and is sufficiently convenient.

203. It has already been mentioned that flowers are said to be irregular when the members of any whorl are of different sizes or shapes, as, for example, in the Pea; and regular, when the opposite is true. Fig. 173 represents one of these regular flowers. A moment's reflection will show that any line whatever drawn across the centre of this diagram will divide it into two exactly similar halves. The term *actinomorphic*, as well as "regular," is applied to all such flowers. Flowers, on the other hand, which can be cut symmetrically in one vertical plane only are *zygomorphic*.

204. In this book, as in most English books, the term "symmetrical" is employed to indicate that the whorls consist of the same number of members each, and it is, in fact, the same in meaning as "isomerous." The later German botanists define a symmetrical flower as "one which can be divided vertically into two halves resembling each other like an object and its reflected image."

We shall now proceed to consider in detail the variations in form assumed by the floral organs individually.

205. **The Calyx.** As you are now well aware, this term is applied to the outer circle of floral leaves. These are usually green, but not necessarily so; in some Exogens, and in nearly all Endogens, they are of some other colour. Each division of a calyx is called a *sepal*, and if the sepals

are entirely distinct from each other, the calyx is *polysepalous;* if they are united in any degree, it is *gamosepalous.* A calyx is *regular* or *irregular* according as the petals are of the same or different shape and size

206. In a gamosepalous calyx, if the sepals are not united to the very top, the free portions are known as *calyx-teeth*, or, taken collectively, as the *limb* of the calyx. The united portion, especially if long, as in Willow-herb, is called the *calyx-tube*, and the entrance to the tube its *throat.* In many plants, particularly those of the Composite Family, the limb of the calyx consists merely of a circle of bristles or soft hairs, and is then described as *pappose.* In other cases the limb is quite inconspicuous, and so is said to be *obsolete.* A calyx which remains after the corolla has disappeared, as in Mallow (Fig. 31), is *persistent.* If it disappears when the flower opens, as in our Bloodroot, it is *caducous;* and if it falls away with the corolla, it is *deciduous.*

We must repeat here, that when calyx and corolla are not both present, the circle which is present is considered to be the calyx, whether green or not.

207. **The Corolla.** The calyx and corolla, taken together, are called the *floral envelopes.* When both envelopes are present, the corolla is the inner one; it is usually, though not invariably, of some other colour than green. Each division of a corolla is called a *petal*, and the corolla is *polypetalous* when the petals are completely disconnected; but *gamopetalous* if they are united in any degree, however slight. The terms *regular* and *irregular*, applied to the calyx, are applicable also to the corolla, and the terms used in the description of leaves are applicable

to petals. If, however, a petal is narrowed into a long and slender portion towards the base, that portion is known as the *claw*, whilst the broader upper part is called the *limb* (Fig. 176). The leaf-terms are then applicable to the limb.

Fig. 176.

208. Gamopetalous corollas assume various forms, most of which are described by terms easily understood. The forms assumed depend almost entirely on the shape of the petals which, when united, make up the corolla. If these, taken separately, are linear, and are united to the top, or nearly so, the corolla will be tubular (Fig. 177). If the petals are wedge-shaped, they will, by their union, produce a *funnel-shaped* corolla (Fig. 178). In the *campanulate* or *bell-shaped* form, the enlargement from base to summit is more gradual. If the petals are narrowed abruptly into long claws, the union of the claws into a tube and the spreading of the limb at right angles to the tube will produce the *salver-shaped* form, as in Phlox (Fig. 179). The *rotate* corolla differs from this in having a *very short* tube. The corolla of the Potato is rotate.

Fig. 177.

Fig. 178.

209. The most important *irregular* gamopetalous corollas are the *ligulate*, which has been fully described in the examination of the Dandelion, and the *labiate*, of which we found an example in Catnip (Fig. 59). The corolla of Turtle-head (Fig. 180) is another

Fig. 176.—Single petal of a Pink. Fig. 177.—Tubular corolla of a Honeysuckle.
Fig. 178.—Funnel-shaped corolla of Calystegia.

example. When a labiate corolla presents a wide opening between the upper and lower lips, it is said to be *ringent*: if the opening is closed by an upward projection of the lower lip, as in Toadflax (Fig. 181), it is said to be *personate*, and the projection in this case is known as the *palate*. A good many corollas, such as those of Toadflax, Dicentra, Snapdragon, Columbine, and Violet, have protuberances or *spurs* at the base. In Violet one petal only is spurred; in Columbine the whole five are so.

Fig. 179.

Fig. 180.

Fig. 181.

210. *Æstivation.* This is the term applied to the mode in which the sepals and petals are folded in the bud. In general, the members of a calyx or of a corolla overlap in the bud, or they do not. If they stand edge to edge, as in the calyx of Mallow, the æstivation is *valvate*. If there is overlapping, and one or more of the members have *both* edges covered, the æstivation is *imbricate*; and if each member has one edge covered and the other uncovered, as in the corolla of Mallow, Evening Primrose, Phlox, &c., it is then said to be *convolute*. Gamopetalous corollas are frequently *plaited* in the bud, and the plaits may be convolute, as in Morning Glory.

Fig. 179.—Salver-shaped corolla of Phlox.
Fig. 180.—Labiate corolla of Turtle head
Fig. 181.—Personate corolla of Toadflax.

211. The Stamens. As calyx and corolla are called collectively the floral envelopes, so stamens and pistil are spoken of collectively as the *essential organs* of the flower. The circle of stamens alone is sometimes called the *androecium*. A complete stamen consists of a slender stalk known as the *filament*, and one or more small sacs called collectively the *anther*. The filament, however, is not uncommonly absent, in which case the anther is *sessile*. As a general thing, the anther consists of two oblong cells with a sort of rib between them called the *connective*, and that side of the anther which presents a distinctly *grooved* appearance is the *face*, the opposite side being the *back*.

Fig. 182.

Fig. 183

Fig. 184.

The filament is invariably attached to the connective, and may adhere through the entire length of the latter, in which case the anther is *adnate* (Fig. 182); or the base of the connective may rest on the end of the filament, a condition described as *innate* (Fig. 183); or the extremity of the filament may be attached to the middle of the back of the connective, so that the anther swings about: it is then said to be *versatile* (Fig. 184). In all these cases, if the face of the anther is turned towards the centre of the flower, it is said to be *introrse*; if turned outwards, *extrorse*.

Figs. 182, 183, 184. Stamens showing adnate, innate, and versatile attachments of the anther.

The cells of anthers commonly open along their outer edges to discharge their pollen (Fig. 185). In most of the Heaths, however, the pollen is discharged through a minute aperture at the top of each cell (Fig. 186), and in our Blue Cohosh each cell is provided with a lid or valve near the top, which opens on a kind of hinge (Fig. 187). Occasionally, examples of barren or abortive stamens are met with, as the fifth stamen in Turtle Head and Pentstemon. These are filaments without anthers, and are known as *staminodes*.

212 Stamens may be either entirely distinct from each other—in which case they are described as *diandrous*, *pentandrous*, *octandrous*, &c., according to their number (or, if more than twenty, as indefinite)—or they may be united in various ways. If their anthers are united in a circle, while the filaments are separate (Fig. 57), they are said to be *syngenesious;* but if the filaments unite to form a tube, while the anthers remain distinct, they are said to be *monadelphous* (Fig. 32); if they are in two groups they are *diadelphous* (Fig. 37); if in three, *triadelphous;* if in more than three, *polyadelphous*.

Figs. 185, 187, 186.

213. As to **insertion**, when stamens are inserted on the receptacle they are *hypogynous;* when borne on the calyx, *perigynous;* when borne on the ovary, *epigynous;* and if inserted on the corolla, *epipetalous*. They may, however, be borne even on the style, as in Orchis, and then they are described as *gynandrous*.

214. If the stamens are four in number, and in two

Figs. 185, 186, 187.—Anthers exhibiting different modes of dehiscence.

pairs of different lengths, they are said to be *didynamous* (Fig. 60); if six in number, four long and two short, they are *tetradynamous* (Fig. 28); and, finally, if the stamens are hidden in the tube of a gamopetalous corolla they are said to be *included*, but if they protrude beyond the tube they are *exserted* (Fig. 177).

215. **The Pistil.** This is the name given to the central organ of the flower. It is sometimes also called the *gynœcium*. As in the case of the stamens, the structure of the pistil must be regarded as a modification of the structure of leaves generally. The pistil may be formed by the folding of a single carpellary leaf, as in the Bean (Fig. 188), in which case it is *simple*; or it may consist of a number of carpels, either entirely separate from each other or united together in various ways, in which case it is *compound*. By some botanists, however, the term compound is restricted to the case of united carpels. If the carpels are entirely distinct, as in Buttercup, the pistil is *apocarpous*; if they are united in any degree, it is *syncarpous*. A pistil of one carpel is *monocarpellary*; of two, *dicarpellary*; and so on, to *polycarpellary*.

Fig. 188.

Fig. 188.—Legume of the Bean.

216. The terms *inferior* and *superior*, as applied to the pistil, describe its situation upon the axis relative to that of the calyx, corolla, and stamens. It will be remembered that the end of the peduncle is usually enlarged, forming what is called the *torus* or receptacle. Usually the receptacle is a little higher in the centre

than at its margin, and as the gynœcium occupies this central part, its position is above that of the other floral leaves, as shown in Fig. 189. Here the pistil is *superior*, and the stamens and petals hypogynous. But frequently the outer part of the receptacle grows more vigorously than the centre, forming, in fact, a cup with the pistil in the bottom of it, and the stamens and petals around

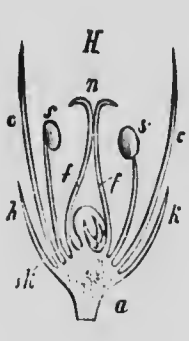


Fig. 189.

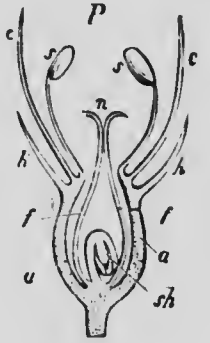


Fig. 190.

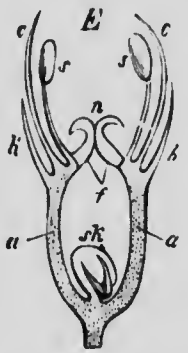


Fig. 191.

its margin (Fig. 190). In this case the pistil may be described as half-inferior, and the stamens and petals as perigynous. Often the cup-shaped receptacle grows fast to the ovary all round. In other cases, the carpels, instead of being developed from the bottom of the cup, spring from the margin, thus forming a roof-like disk, around the edge of which the stamens are attached (Fig. 191). Here the stamens are epigynous, and the ovary is truly *inferior*. Other cases of epigyny and perigyny arise from the adnation (growing together) of the floral whorls without exceptional development of the

Figs. 189, 190, 191.—Diagrams illustrating hypogynous (*H*), perigynous (*P*), and epigynous (*E*) flowers; *a*, axis; *k*, calyx; *c*, corolla; *s*, stamens; *f* carpels; *n*, stigma; *sk*, ovule. (Prantl.)

receptacle. The cases of the Rose, Cherry, and Apple have already been referred to (Chapter VI.).

217. In our examination of the Marsh Marigold (Figs. 24 and 25) we found an apocarpous pistil of several carpels. We found also that each carpel contained a number of seeds, and that in every case the seeds were attached to that edge of the carpel *which was turned towards the centre of the flower*, and that, as the carpels ripened, they invariably split open along that edge, but not along the other, so that the carpel when opened out presented the appearance of a leaf with seeds *attached to the margins*. The inner edge of a simple carpel, to which the seeds are thus attached, is called the *ventral suture*, the opposite edge, corresponding to the mid-rib of a leaf, being the *dorsal suture*.

218. If we suppose a number of simple carpels to approach each other and unite in the centre of a flower, it is evident that the pistil so formed would contain as many cells as there were carpels, the cells being separated from each other by a *double wall*, and that the seeds would be found arranged about the centre or axis of the pistil ; and this is the actual state of things in the Tulip, whose pistil is formed by the union of three carpels. When the pistil ripens, the double walls separating the cells split asunder. To these separating walls the name *dissepiment* or *partition* is given.

219. The cells are technically known as *loculi*. An ovary with one cell is *unilocular* : with two, *bilocular* : with several, *multilocular*. Between the unilocular and multilocular forms there are all shades of gradation. In some cases, as, for example, in Saxifrage, the carpels

are united below but separate above. Sometimes, also, false partitions are formed across the loculi in the course of growth. In the Mints, for instance, there are at first but two loculi; eventually, however, there are four, which completely separate at the time of ripening.

220. But it often happens that though several carpels unite to form a compound pistil, there is but *one cell* in the ovary. This is because the separate carpellary leaves have not been folded before uniting, but have been joined edge to edge, or rather with their edges slightly turned inwards. In these cases the seeds cannot, of course, be in the centre of the ovary, but will be found *on the walls*, at the junction of the carpels (Figs. 192 and 193). In some plants the ovary is one-celled, and the seeds are arranged round a column which rises from the bottom of the cell (Figs. 194 and 195). This case is explained by the early obliteration of the partitions, which must at first have met in the centre of the cell. Special cases, however, are found in which no trace of partitions has been observed, and these must consequently be explained by the actual upward growth of the axis into the centre of the ovary.

Fig. 193. Fig. 192.

Fig. 194. Fig. 195.

221. In all cases the line or projection to which the seeds are attached is called the *placenta*, and the term **placentation** has reference to the manner in which the placentas are arranged. In the simple pistil the placentation is *marginal* or *sutural*. In the syncarpous

Figs. 192, 193.—Compound one-celled ovary of Mignonette.

Figs. 194, 195.—Sections of ovary of a Pink, showing free central placentation.

pistil, if the dissepiments meet in the centre of the ovary, thus dividing it into separate cells, the placentation is *central* or *axile*; if the ovary is one-celled and bears the seeds on its walls, the placentation is *parietal*; and if the seeds are attached to a central column it is *free central*.

222. Besides the union of the ovaries there may also be a union of the styles, and even of the stigmas.

223. A very exceptional pistil is found in plants of the Pine Family. Here the ovules, instead of being enclosed in an ovary, are usually simply attached to the inner surface of an open carpellary leaf or scale, the scales forming what is known as a *cone* (Figs. 196, 197, and 198). The plants of this family are hence called *gymnospermous*, or naked-seeded.

Fig. 196.

Figs. 197, 198

224. **Nectaries.** This name is given to that part of a flower which has been specially formed for the secretion of honey. The nectaries need not, however, be looked upon as separate or independent organs. Sometimes they are to be found at the base of the petals, as in Buttercup; sometimes at the base of the stamens, as in the Grape. Very commonly they are at the bottom of deep spurs formed on one or more divisions of the perianth, as in Violet, many Orchids, and in Columbine.

225. **Phyllome and Trichome.** To all leaf-forms, whether ordinary foliage-leaves or those special modifications which make up the flower—sepals, petals, stamens

Fig. 196. A cone.
Fig. 197. Single scale showing position of the two seeds on the inner face.
Fig. 198.—One of the winged seeds removed.

and carpels—the general term *phyllome* is applicable. The characteristic of the phyllome is that it is a lateral outgrowth of the stem or its branches.

226. The term *trichome*, on the other hand, is applicable to any hair-like appendage on the surface of the plant generally, whether of root, stem, or leaf. The commonest form of trichome is the *hair*. The root-hairs which generally clothe the surface of young roots are of great importance as absorbing agents. Each root-hair consists of a single, delicate, tube-like cell with extremely thin walls. Other hairs may consist of several such cells placed end to end. Others, again, may branch extensively. It sometimes happens that the terminal cell of a hair produces a gummy substance which comes away with the slightest touch. The sticky surfaces of many common plants are due to the presence of such hairs, which are then described as *glandular*. Gummy matters are also secreted by *glands* close to the surface of the plant. *Peltate* hairs are occasionally met with, as in the leaves of Shepherdia. They give a scurfy appearance to the surface upon which they grow. Then there are hairs which secrete *odorous* fluids, as, for example, those upon the surface of the Sweet Brier. These probably serve to attract insects. *Stinging* hairs are also common. They contain an irritating fluid. When the point of the hair pierces the skin it is broken off, and the fluid then escapes into the wound.

227. Besides the trichome forms just mentioned, there are also *bristles*, formed from hairs by the gradual thickening and hardening of their walls, and *prickles*, such as those of Sweet Brier (Fig. 199), which consist of many

hard-walled woody cells closely packed together. That prickles are really trichomes is shown by the fact that when the bark is stripped off they come away along with it. *Spines*, on the other hand (Fig. 200), are lateral outgrowths of the stem. They are, in fact, generally stunted branches, and will be found to spring originally from the axils of leaves. Occasionally the petiole of a leaf is converted into a spine, which then becomes a true phyllome. Ovules are generally regarded as trichomes since they arise from the inner surface of the carpels.

Fig. 199.

Fig. 200.

228. **The Fruit.** In coming to the consideration of the fruit, you must for the present lay aside any popular ideas you may have acquired as to the meaning of this term. You will find that, in a strict botanical sense, many things are fruits which, in the language of common life, are not so designated. For instance, we hardly speak of a pumpkin or a cucumber as fruit, and yet they are clearly so, according to the botanist's definition of that term. A fruit may be defined to be *the ripened pistil together with any other organ, such as the calyx or receptacle, which may be adherent to it.* This definition will, perhaps, be more clearly understood after a few specimens have been attentively examined.

229. For an example of the simplest kind of fruit let

Fig. 199.—Prickles of Sweet Brier. Fig. 200.—Spines of the Hawthorn.

us revert to our Buttercup. As the carpels ripen, the style and stigma are reduced to a mere point. On cutting open one of these carpels when fully ripe, we find it contains a single seed, not quite filling the cavity, but attached at one point to the wall of the latter. What you have to guard against, in this instance, is the mistake of considering the entire carpel to be merely a seed. It is a seed enveloped in an outer covering which we called the ovary in the early stages of the flower, but which, now that it is ripe, we shall call the *pericarp*. This pericarp, with the seed which it contains, is the fruit. The principal difference between the fruit of Marsh Marigold and that of Buttercup is that, in the former, the pericarp envelopes several seeds, and, when ripe, *splits open down one side*. The fruit of Buttercup does not thus split open. In the Pea, again, the pericarp encloses several seeds, but splits open along *both* margins. The fruits just mentioned all result from the ripening of *apocarpous* pistils, and they are consequently spoken of as *apocarpous fruits*.

230. In Willow-herb, you will recollect that the calyx-tube adheres to the whole surface of the ovary. The fruit in this case, then, must include the calyx. When the ovary ripens, it splits longitudinally into four pieces (Fig. 41), and, as the pistil was *syncarpous*, so also is the fruit.

231. In the Peach, Plum, Cherry, and *stone-fruits* or *drupes* generally, the seed is enclosed in a hard shell called a *putamen*. Outside the putamen is a thick layer of pulp, and outside this, enclosing the whole, is a skin-like covering. In these fruits all outside the seeds is the pericarp. In one respect these stone-fruits resemble the

fruit of the Buttercup: they do not split open in order to discharge their seeds. All fruits having this peculiarity are said to be **indehiscent,** whilst those in which the pericarp opens, or separates into pieces, are **dehiscent.**

232. In the Apple (Fig. 50) and Pear, the seeds are contained in five cells in the middle of the fruit, and these cells are surrounded by a firm fleshy mass, which is mainly an enlargement of the calyx. In fact, the remains of the five calyx-teeth may be readily detected at the end of the apple opposite the stem. As in Willow-herb, the calyx is adherent to the ovary, and therefore calyx and ovary together constitute the pericarp. These *fleshy fruits,* or *pomes,* as they are sometimes called, are of course *indehiscent.*

233. In the Currant, as in the Apple, you will find the remains of a calyx at the top, so that this fruit, too, is *inferior,* but the seeds, instead of being separated from the mass of the fruit by tough cartilaginous cell-walls, as in the Apple, lie imbedded in the soft, juicy pulp. Such a fruit as this is a *berry.* The Gooseberry and the Grape are other examples. The Pumpkin and other *gourds* are similar in structure to the berry; but, besides the soft inner pulp, they have also a firm outer layer and a hard rind. The name *pepo* is generally given to fruits of this sort.

Fig. 201.

234. A Raspberry or Blackberry (Fig. 201) proves, on examination, to be made up of a large number of juicy little drupes, aggregated upon a central axis. It cannot, therefore, be a true berry, but may be called an *aggregated* fruit.

Fig. 201.—Aggregated fruit of the Raspberry.

235. A strawberry (Fig. 202) is a fruit consisting chiefly of a mass of pulp, having its surface dotted all over with little carpels (achenes), similar to those of the Buttercup. The flesh of the Strawberry is simply an enlarged *receptacle;* so that this fruit, also, is not a true berry.

Fig. 202.

236. The fruit of Sweet Brier (Fig. 45) consists of a red fleshy calyx, lined with a hollow receptacle which bears a number of achenes. This fruit is, therefore, analogous to that of the Strawberry. In the latter the achenes are on the outer surface of a *raised* receptacle, while in the former they are on the inner surface of a *hollow* receptacle.

When other parts of the flower are combined with the ovary in fruit, as in Apple, Rose, and Strawberry, the result is sometimes described as a *pseudocarp*, or spurious fruit.

237. The cone of the Pine (Fig. 116) is a fruit which differs in an important respect from all those yet mentioned, inasmuch as it is the product, not of a single flower, but of as many flowers as there are scales. It may, therefore, be called a *collective* or *multiple* fruit. The Pine Apple is another instance of the same thing.

238. Of dehiscent fruits there are some varieties which receive special names. The fruit of the Pea or Bean (Fig. 188), whose pericarp splits open along *both* margins, is called a *legume;* that of Marsh Marigold (Fig. 25), which opens down one side only, is a *follicle*. Both of these are apocarpous.

Fig. 202.—Section of a Strawberry.

239. Any syncarpous fruit having a dry *dehiscent* pericarp is called a *capsule*. The dehiscence of syncarpous or polycarpellary fruits is of several kinds. If the rupture takes place along the partitions the fruit will be split up into its original carpels; this form of dehiscence is *septicidal* (Fig. 203). But the dehiscence may take place along the dorsal suture of each carpel, halfway between the partitions, so that the opening is into the loculus; this mode is known as *loculicidal* (Fig. 204). Or again, the valves (separate pieces of the pericarp) may fall away, leaving the partitions standing; this dehiscence is *septifragal* (Fig. 205).

Fig. 203.

Fig. 204.

240. A long and slender capsule, having two cells separated by a membranous partition bearing the seed, and from which, when ripe, the valves fall away on each side, is called a *silique* (Fig. 206). If, as in Shepherd's Purse (Fig. 29), the capsule is short and broad, it is called a *silicle*. If the capsule opens *horizontally*, so that the top comes off like a lid, as in Purslane (Fig. 207), it is a *pyxis*.

Fig. 205.

241. Any dry, one-seeded, *indehiscent* fruit is called an *achene*, of which the fruit of Buttercup (Fig. 14) is an

Figs. 203, 204, 205.—Diagrams illustrating septicidal, loculicidal, and septifragal dehiscence.

example. In Wheat the fruit differs from that of Buttercup in having a closely fitting and *adherent* pericarp. Such a fruit is called a *caryopsis* or *grain*. A *nut* is usually syncarpous, with a hard, dry pericarp. A *winged* fruit, such as that of the Maple (Fig. 208), is called a *samara* or *key*.

Fig. 206.

242. A fruit which splits up when ripe into several one-seeded pieces is called a *schizocarp*. The samara of the Maple is a good example; also the fruit of Catnip, which splits up at maturity into four one-seeded portions. The fruit of Mallow is another common instance. The separate portions in these cases are called *mericarps*. In some leguminous plants the pod breaks up *transversely* into one-seeded portions, giving rise to the form called a *loment*.

Fig. 207.

Fig. 208.

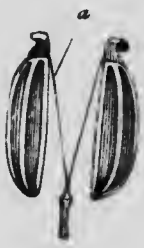


Fig. 209.

243. A special schizocarp is that of Umbelliferous plants (Fig. 209). Here the fruit splits into two mericarps, each attached, however, by a fibre to the axis. Such a fruit is called a *cremocarp*.

244. **The Seed.** The seed has already been described as the *fertilized ovule*. During the formation of the carpels, the ovules arise as outgrowths from the inner surface of the ovary, mostly, as has been pointed out, upon the *margins* of the carpellary leaves, but occasionally also upon the surface generally. At first the ovule

Fig. 206.—Silicle of Stock. Fig. 207.—Pyxis of Purslane.
Fig. 208.—Samara of Maple.
Fig. 209.—Cremocarp of an Umbellifer; *a*, the fibre attaching the mericarp to the axis. (Thome.)

is a simple, soft mass with no indication whatever of the covering so manifest in ripe seeds of all kinds. Very soon, however, after the appearance of the body of the ovule, a circular ridge is developed upon it, and this gradually extends upwards over the surface so as to form a coat, which at length entirely covers it except at the very apex, where a minute opening is left. Very commonly, but not always, a second coat is developed exactly in the same manner, outside the first, and an opening is left in this coat also, precisely over the other. This minute passage through both coats to the ovule body has already been named the *micropyle*. The two coats are known as the *primine* (generally, though not always, applied to the outer) and the *secundine*, and the central body is the *nucleus*.

245. If the ovule appears to arise directly from the placenta without the intervention of a stalk, it is *sessile*; but if a stalk is present, this is known as the *funiculus*. In the accompanying diagram (Fig. 210) which represents a section of the complete ovule, *k* is the nucleus; *ai*, the primine; *ii*, the secundine; *m*, the micropyle; *f*, the funiculus. The point *(c)* where the two coats and the nucleus are blended together is called the *chalaza*. The portion of the nucleus marked *em* is the cavity called the embryo-sac, already referred to in Chapter II.

246. It must now be pointed out that though the ovules at the commencement of their growth are straight, as in the diagram just described, yet they do not commonly remain so. Very often the ovule bends over so as to appear completely inverted, in which case the funiculus grows fast to one side of the primine, becoming completely fused

with it, and forming what is then called the *raphe*. Fig. 211 represents this condition, *r* being the raphe, *s* the chalaza, and the other letters corresponding to those in Fig. 210.

Sometimes the curving of the ovule upon itself is not carried to this extreme, and an intermediate form is presented, as in Fig. 212.

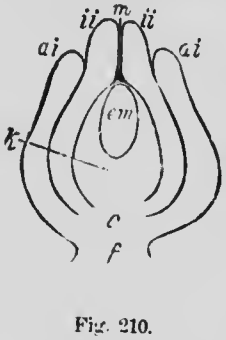


Fig. 210.

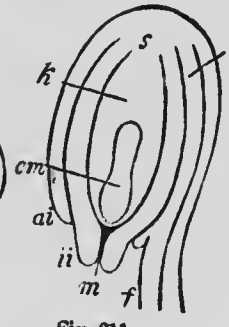


Fig. 211.

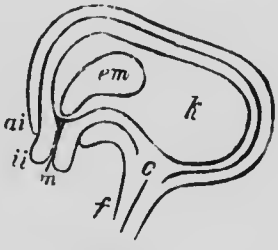


Fig. 212.

If the ovule remains straight it is said to be *orthotropous;* if completely inverted, *anatropous;* if half bent over, *campylotropous.*

247. **Pollination.** The process of fertilization, by which the ovule is converted into the seed, has been briefly described in Chapter II. A few words may be added here upon *pollination*—the process of supplying pollen to the stigma. In very many flowers which have both stamens and pistil (and hence called *hermaphrodite*), the process is very simple. Either the anthers and stigma are so close together that the pollen cannot fail to be deposited upon the stigma immediately upon the opening of the anther, or the stigma is upon a lower level, so that the pollen drops upon it, or, in special cases, as in

Figs. 210, 211, 212.—Diagrams of orthotropous, anatropous, and campylotropous ovules. (Prantl.)

Impatiens and Wood Sorrel, besides the ordinary large flowers, there are special small ones (known as *cleistogamous* flowers) whose floral envelopes do not open, thus *compelling* self-fertilization. But it is well established that in a vast number of cases the ovules in any given flower have to depend for fertilization upon the pollen of some other flower. Nature seems to have provided against self-fertilization by various contrivances. Sometimes the relative positions of the anthers and the stigma in the same flower are such as to render it impossible. Sometimes the pollen comes to maturity and is shed from the anthers before the stigma is in a suitable condition to receive it; whilst, on the other hand, the stigma is often developed first and has withered before the opening of the anthers. (Flowers showing these peculiarities are said to be *dichogamous*.) When for any reason cross-fertilization has become a necessity, the conveyance of the pollen from one flower to another is ensured in various ways. When the flowers are inconspicuous, as in Grasses, the wind is the great agent, and flowers so fertilized are said to be *anemophilous*. In other cases the flowers, either by their brightness or their odour, attract insects in quest of honey, and these then become the carriers of the pollen. Flowers of this sort are said to be *entomophilous*, and are usually so constructed as to the situation of their honey receptacles, and the relative position of anthers and stigma, as to ensure the transfer of the pollen from the anther of one flower to its destination upon the stigma of another. The case of the Orchids has already been referred to in section 92.

248. After fertilization, the embryo, or young plantlet, as exhibited in the seed, begins its growth in that end of

the embryo-sac which is next the micropyle, and about the same time, in the other end of the embryo-sac, there begins a deposit of matter intended for the nourishment of the embryo during the germination of the seed. This deposit has been already referred to under the name of *albumen*. It is also known as *endosperm*. As the embryo developes, this endosperm or albumen may be completely absorbed by it, so that at maturity the embryo will occupy the whole space within the seed-coats, as in the Bean. In this case the seed is *exalbuminous*. In other cases, as in Indian Corn, the endosperm remains as a distinct mass with the embryo embedded in it, or sometimes wrapped round it. Seeds of this kind are *albuminous*. Rarely this nourishing material is deposited outside the embryo-sac, in the body of the ovule. It is then known as *perisperm*.

249. The ripened seed presents very different aspects in different plants. It may be resolved, however, into the *nucleus* and the *integument* (the *spermoderm* of some botanists). The former is made up of the embryo, together with the endosperm or perisperm, if present, while the latter consists of two layers: an outer, known as the *testa*, and an inner, the *tegmen*. The scar showing where the seed has been attached to the placenta is called the *hilum*; it is very distinct in the Bean.

250. Besides the integument just mentioned, occasionally an additional outer coat is formed, to which the term *aril* is applied. The fleshy red covering of the seed in our Ground Hemlock is a good example.

251. The seeds of Willow-herb, Milkweed, and many other plants are furnished with tufts of hair-like bristles

which facilitate their dispersion by the wind. These tufts grow from the testa of the seed, and are not to be confounded with the pappus of the Thistle, Dandelion, &c.; the latter, it will be remembered, is an outgrowth of the calyx.

252. The embryo, as already explained, generally consists of an axis or stem called the *radicle* (or, more properly, the *caulicle*, because it is in all respects a true stem and not a root), and one or more leaves called *cotyledons*, with sometimes, also, a bud known as the *plumule*. As to the number of cotyledons, it may be repeated here that seeds are, as a rule, either dicotyledonous or monocotyledonous. Some plants of the Pine Family, however, have six cotyledons, whilst, on the other hand, in the Orchids and a few other plants, these organs are altogether wanting.

253. The cotyledons vary greatly in thickness. In the Maple, for example, they are very thin, while in the Pea, the Bean, and the Oak they are extremely thick and fleshy.

254. **Germination.** If a seed is supplied with proper warmth and moisture it soon begins to swell and soften by absorption of water, with the effect of bursting the seed-coats to a greater or less degree. At the same time the process of *growth* is begun. This early growth of the embryo is *germination*. The details of the process vary somewhat according to the structure of the seed. In dicotyledons, if the seed-leaves are thin and leaf-like, containing within themselves but scanty store of nourishment, the radicle will grow throughout its length so as to raise the cotyledons above the soil, where they at once

expand and become the earliest leaves of the new plant; and during this upward extension of the radicle a root also is being rapidly developed from its lower end. It is important, also, to notice here that the mode of growth of the root portion is at variance with that of the radicle or stem proper, for while the latter grows *throughout its length*, the former grows by the addition of successive new portions *to its extremity*. (The protection of the growing root by a *root-cap* has already been referred to.) As soon as the root is prepared to absorb nourishment from the soil, then, and not till then, the development of the next bit of stem commences between the first pair of leaves.

255. But when the cotyledons are loaded with nourishment, as in the Bean, it will generally be found that the elements of additional bits of stem (the plumule) are already present in the embryo, and although the radicle may lengthen so as to lift the cotyledons above the surface, yet these do not, as in the thin-leaved embryos, fully perform the office of foliage-leaves; their true function is to supply the newly developing parts with nourishment, and when this duty is performed they usually drop off. In fact, it is not uncommon for such extremely fleshy cotyledons to remain under the surface altogether, as in the case of the Pea and the Acorn. In these cases the growth of the radicle is but slight. The plumule and the end of the radicle are liberated from the seed, and the former at once grows vigorously upward, being practically independent of the root as long as the stock of nourishment in the cotyledons holds out. Simultaneously with the development of the stem, the root is strongly developed from the end of the short radicle.

256. In the monocotyledons the process of germination is much the same as that just described, with the important difference, however, that the primary root from the end of the radicle can scarcely be said to develope at all, a cluster of fibrous roots bursting out almost at once from its sides. Indian Corn answers very well as an illustration. Here the seed, largely made up of endosperm or albumen, remains in the ground. The single cotyledon is wrapped round the plumule and adheres by its back to the endosperm, acting thus as a medium through which nourishment is absorbed, and of course not being carried up to the surface. The plumule is rapidly carried upward, developing alternate leaves, and the numerous fibrous roots are given off from the sides of the short radicle.

257. The young student is strongly recommended to investigate for himself the phenomena of germination as exhibited in common seeds. For this purpose he may place a few Windsor beans and grains of Indian Corn between layers of moist flannel or coarse paper in a shallow dish. If kept damp, germination will begin in a day or two, and if sufficient specimens have been provided the process may be observed at various stages. Trial should also be made of the length of time during which seeds will retain their vitality. Many seeds, such as those of Elm and Poplar, will be found to germinate only if they have been kept fresh and not permitted to dry up, whilst others, such as Indian Corn and Wheat, and in general those containing starch, may be kept for a very long time without losing their germinating power.

INDEX AND GLOSSARY.

The numbers refer to sections, unless Figures are specified.

Abruptly pinnate, 180.

Absorption by roots, 2.

Accumulescent: apparently without a stem, 18.

Accessory fruits: such as consist chiefly of an enlargement of some organ, such as the calyx or receptacle, not organically united with the pistil, 235.

Achenium or Achene, 54, 56, 211.

Achlamydeous: having neither calyx nor corolla, 74.

Acicular, Fig. 145.

Acorn, 71.

Actinomorphic flowers, 203.

Acuminate: with a long tapering point.

Acute: sharp-pointed, 17.

Acyclic flowers, 19.

Adherent: a term applied to (1) union of unlike parts, as stamens with corolla, &c.

Aduate, 52, 211.

Adventitious: occurring [illegible] the natural position.

Adventitious roots, 134.

Adventitious buds, 130.

Aerial roots, 134.

Æstivation: the folding of the floral envelopes in the bud, 210.

Aggregated fruits, 234.

Air-plants (epiphytes), 87.

Albumen (of the seed): solid nourishing matter distinct from the embryo, 12, 80, 117, 218.

Albuminous seeds, 80, 248.

Alternate (leaves), 158.

Ament or Catkin, Figs. 68, 69.

Amplexicaul: clasping a stem.

Anatropous: a term applied to ovules when inverted, so that the micropyle is close to the point of attachment, 206.

Androecium: the circle of stamens collectively, 211.

Androus: an ending of adjectives descriptive of stamens, *e. g.*, monandrous, polyandrous, &c.

Anemophilous, 71, 217.

Angiospermous: applied to plants whose seeds are enclosed in an ovary, 121, 120.

Annual: a plant which grows from the seed, flowers, and dies in the same season, 136.

Anterior, 197.

Anther: the essential part of a stamen containing the pollen, 6, 211.

Apetalous: without a corolla; having only one set of floral envelopes, 20.

Axis of leaves, 177.

Apocarpous: applied to pistils when the carpels are free from each other, 7, 21, 215, 229.

Appendage: anything attached or added.

Appressed: in contact, but not united.

Aquatic: growing in the water, whether completely or only partially immersed.

Arborescent: resembling a tree.

Aril, 126, 250.

Arrow-shaped, Fig. 155.

Ascending: rising upwards in a slanting direction; applied chiefly to weak stems.

Ascending axis: the stem of a plant.

Ascidium: a pitcher-shaped leaf, Fig. 189.

Auriculate: same as *auricled*: having rounded lobes at the base: applied mostly to leaves.

Awl-shaped, Fig. 117.

Awn: a bristle, such as is found on the glumes of many Grasses, Barley for example, 108.

Axil, 3.

Axile: relating to the axis, 221.

Axillary: proceeding from an axil, 11, 138.

Axillary buds, 138.

Axillary flowers, 186.

Axis: the stem and root, 131.

Baccate: like a berry.

Bases of leaves, 179.

Bearded: furnished with hairs like the petals of some Vetches, &c.

Bell-shaped, 208.

Berry, 233.

Biennial: a plant which grows from seed in one season, but produces its seeds and dies in the following season, 133, 136.

Bifidulate: having two leaflets.

Bifidate: two-lipped, Fig. 180.

Binocular, 219.

Bipinnate: twice pinnate, Fig. 107.

Bipinnatifid: twice pinnatifid, 176.

Blade: the broad part of a leaf or petal, 1, 15.

Botryose, 143.

Botryose inflorescence, 185, 189.

Bracts, 19, 11, 191.

Bractcate: subtended by a bract.

Bracteolets: secondary bracts growing on pedicels, 191.

Branches, 3, 132, 141.

Branching, Modes of, 141.

Bristles, 227.

Bud: an undeveloped stem or branch, 137.

Buds on roots, 131, 139.

Bulb, 82, 91, 142.

Bulbiferous: producing bulbs.

Bulblets, 145.

Bulboous: like a bulb in shape.

Calcareous, 206.

Calyx, 5, 13, 205.

Calyx teeth, 206.

Calyx tube, 206.

Campanulate, 208.

Campylotropous, 216.

Capillary: fine and hair like.

Capitulum: same as *head*, 189.

Capsule, 230.

Carinal, or keel: the two coherent petals in the front of a flower of the Pea kind, Fig. 36.

Carpel, 7.

Carpellary: relating to a carpel, *etc.*, *a carpellary leaf*, &c.

Cartilaginous: tough.

Caryopsis, 102, 241.

Catkin, 71, 74, 121, 189.

Caulescent: with an evident stem.

Cauliele: another name for the radicle, 79, 252.

Cauline: relating to the stem, *etc.*, *cauline leaves*, &c., 1, 13, 28.

Centrifugal inflorescence, 197.

Centripetal inflorescence, 186.

Chalaza: the part of an ovule where the coats are united to the nucleus, 215.

Chlorophyll, 156.

Ciliate, 182.

Circinate: curled up like the young frond of a Fern, 106.

Circumcissile: opening as does a pyxis, Fig. 207.

Claw of a petal, 1, 37.

Cleistogamous flowers, 217.

Climbing stems, 143.

Club-shaped: with the top part more developed than the upper as the style of Dog's-tooth Violet, Fig. 82.

Clustered, 133, 161.

Coats of the ovule, 214.

Coherent: a term applied to the union of like parts, 26.

Cohesion, 26.

Collective Fruits, 237.

Column, 91.

Coma: a tuft of hairs, such as that on the seed of Dandelion, Fig. 58.

Complete, 8.

Compound or Composite flowers, 62.

Compound leaf, 43, 167.

Compound pistil, 215.

Compound spike, corymb, &c., 189.

Conduplicate vernation, 166.

Cone, 121, 233.

Conical, 133.

Coniferous: bearing cones.

Connate: grown together.

Connate-perfoliate, Fig. 165.

Connective, 65, 211.

Convolute: rolled inward from one edge, 28, 88, 166, 210.

Cordate, 175.

Corm, 94, 151.

Corolla, 5, 13, 15, 207.

Corymb, 189.

Corymbose: like a corymb.

Cotyledons, 78, 117, 252.

Creeping, 119.

Cremocarp, 243.

Cross-fertilization, 217.

Cruciform: cross-shaped, as the flowers of Shepherd's Purse, &c.

Culm, 103, 150.

Cuneate: wedge shaped.

Cuspidate, Fig. 161.

Cycle, 139.

Cyclic flowers, 195.

Cyme, 191.

Cymose: like a cyme, 113, 185.

Decandrous: with ten separate stamens.

Deciduous, 5, 206.

Decompound: applied to leaves whose blades are divided and sub-divided.

Decumbent: applied to stems which lie on the ground but turn upward at the extremity.

Decurrent, Fig. 166.

Decussate: applied to the arrangement of leaves, when successive pairs of opposite leaves are at right angles, as in the plants of the Mint Family, 158.

Definite inflorescence, 187, 191.

Deflexed: bent down.

Dehiscence of anthers, Figs. 185, 186, 187.

Dehiscent, 231.

Deliquescent: applied to stems which dissolve into branches.

Deltoid, Fig. 148.

Dentate, 178.

Depauperate: unnaturally small.

Depressed: flattened down.

Descending axis: the root, 131.

Determinate inflorescence, 187, 191.

Diadelphous: applied to stamens, 10, 212.

Diandrous: with two separate stamens, 212.

Diarpellary, 215.

Dichasium, 116.

Dichlamydeous: having both sets of floral envelopes.

Dichogamous, 217.

Dichotomous branching, 115.

Dicotyledonous, 78.

Dicotyledons, 80.

Didynamous (stamens), 29, 65, 214.

Digitate, 168.

Dimerous flowers, 196.

Dioecious, 71.

Disk: in flowers of the Composite Family, the centre of the head as distinguished from the border, 62; a fleshy enlargement of the receptacle of a flower, 58, 75, 126.

Dissected: finely cut.

Dissepiment, 218.

Distinct: not coherent (see Coherent).

Divergent: separating from one another.

Dodecandrous: with 12 distinct stamens.

Dorsal suture, 217.

Double flowers: abnormal flowers in which stamens and carpels have been transformed into petals.

Downy: covered with soft hairs.

Drupe, 51, 231.

Drupelet: a little drupe.

Elliptical: same as oval. Fig. 116.

Emarginate, 177.

Embryo, 12, 78, 117.

Embryo-sac, 16, 215.

Emersed: raised above the surface of water.

Endocarp: "When the wall of a pericarp form two or more layers of dissimilar texture, the outer layer is called the *Epicarp*, the middle one *Mesocarp*, and the innermost *Endocarp*." *Gray*.

Endogen, 119.

Endogenous growth, 119.

Endosperm, 218.

Enneandrous: with nine distinct stamens.

Entire, 178.

Entomophilous, 71, 75, 88, 217.

Ephemeral: lasting one day only.

Epicalyx, 35, 50.

Epicarp: see Endocarp.

Epigynous: inserted on the ovary, 58, 90, 213, 216.

Epipetalous: inserted on the corolla, 60, 65, 213.

Epiphytes, 135.

Equitant (leaves), 88, 157.

Essential organs, 17, 211.

Evergreen: retaining foliage during winter, 122, 125.

Exalbuminous, 80, 218.

Excurrent: said of main stems which are distinct and well marked to the top as in the Pine and Fir; the reverse of deliquescent.

Exogen, 81.

Exogenous growth, 81.

Exserted: protruding, 214.

Exstipulate, 181.

Extine, 123.

Extrorse, 211.

False dichotomy, 110.

Fascicle: a close bundle, either of leaves or flowers.

Fascicled (roots), 133; (leaves), 161.

Feather-veined: same as pinately-veined, 168.

Fertile-flower, 68.

Fertilization, 17.

Fibrous: thread like, 2, 18, 22.

Filament, 6, 211.

Filiform, 183.

Fimbriate: fringed.

Fleshy fruits, 232.

Flora: a description of the plants of a district; a collective name for the whole of the species of a district.

Floral diagram, 197.

Floral envelopes, 11, 207.

Floral formula, 198.

Floral symmetry, 195.

Floret, 61.

Flower: the part of a phanerogamous plant in which the stamens and pistil are situated.

Flower head, 60.

Flower leaves, 11.

Foliaceous: like a leaf in appearance.

Foliage leaves, 11, 146.

Foliolate: having leaflets.

Follicle, 238.

Food, 111.

Forked cyme, 113.

Free, 5, 7, 11.

Free central placentation, 221.

Fruit, 228.

Fugacious: falling away early.

Funicule, 215.

Funnel-shaped, Fig. 178.
Furcate: forked.
Fusiform: same as spindle-shaped, 133.
Galea: an arching petal or sepal as the two upper ones in Catnip, Fig. 70.
Gamopetalous, 207.
Gamophyllous, 81.
Gamosepalous, 31, 205.
Genera: plural of Genus.
Germ: same as embryo.
Germination, 132, 251.
Gibbous: swollen on one side.
Glabrous: 22, 182.
Gladiate: sword-shaped.
Glands: applied generally to cell or hairs on the surfaces of plants in which resinous or oily matters are secreted; but the term is also used to describe any projection, the use of which is not clear, 226.
Glandular: bearing glands, 226.
Glaucous, 182.
Globose: like a globe or sphere.
Glumaceous: bearing or resembling glumes, 111.
Glumes, 101.
Gourd, 233.
Grain, 102, 117, 211.
Granules: particles.
Growing point, 115.
Gymnospermous, 121, 223.
Gymnosperms, 121, 129.
Gynandrous, 91, 213.
Gynœcium, 199, 215.

Habitat: a term applied to the region most favorable to the growth of a plant; the place where it grows naturally.
Hairs, 226.
Hairy, 1.
Halberd-shaped, Fig. 151.
Half-inferior, 49, 216.
Half-superior, 49.
Hastate, Fig. 151.
Head, 189.
Heart-shaped, 174.
Helicoid cyme, 141.
Hemicyclic flowers, 196.
Heptandrous: with seven distinct stamens.
Herb, 118.
Herbaceous, 3, 89, 136, 118.
Hermaphrodite, 217.
Heteromerous flowers, 196.
Hexandrous: with six distinct stamens.
Hilum, 249.
Hirsute: rough with hairs.
Hispid: covered with stiff hairs.
Hoary: densely covered with fine grayish hairs.
Hortus siccus: a botanist's collection of dried plants.
Hybrids: plants resulting from the crossing of nearly related species.
Hypogynous, 24, 29, 213.

Imbricate: overlapping like the shingles on a roof, 210.
Immersed: wholly under water.
Imperfect, 68.
Included, 211.
Incomplete, 19.
Incurved (petals), Fig. 52.
Indefinite, 26, 212.
Indefinite inflorescence, 186, 189.
Indehiscent, 231.
Indeterminate inflorescence, 186, 189.
Indigenous: naturally growing in a country.
Inferior: underneath; farthest from the axis; the ovary is inferior when the calyx adheres to it throughout; the calyx is inferior when free from the ovary, 15, 19, 52, 88, 216.
Inflorescence, 75, 185.
Innate, 211.
Inserted: attached to.
Insertion: the point or manner of attachment, 10, 212.
Integument, 249.
Internodes, 1.

Interruptedly pinnate, Fig. 68.
Intine, 123.
Introrse, 211.
Involucel, 191.
Involucre, 35, 61, 71, 72, 191.
Involute: rolled inward from both edges, 166.
Irregular, 39, 205, 207.
Isomerous: having the parts equal in number, 196.

Joints: a name sometimes given to the nodes of a stem.

Keel, see Carina.
Kernel, 16.
Key-fruit, 241.
Kidney-shaped, Fig. 156.

Labellum (or lip), 90.
Labiate, 65, 209.
Lanceolate, Fig. 118.
Leaf, 1–13.
Leaf-arrangement, 158.
Leaf-green, see Chlorophyll
Leaflet, 167.
Leaf-schedule, 181.
Leaf-stalk, 1.
Leaf-tendril, 150.
Legume, 13, 238.
Leguminous: producing or relating to legumes.
Ligneous: woody.
Ligulate, 62, 209.
Ligule: a strap-shaped corolla: in Grasses, a scale-like projection between the blades of a leaf and the sheath, 103.
Limb, 207.
Linear, Fig. 116.
Lip, 90.
Lobe, 4, 167.
Loculicidal (dehiscence): splitting midway between the partitions, 239.
Loculus, 219.
Lodicule, 104.
Loment: a jointed legume, 242.
Lyrate: pinnately-lobed, with the terminal lobe much larger than the others.

Marcescent: withering persistent.
Margin of leaves, 178.
Marginal: relating to the margin, 221.
Median plane, 197.
Membranous: thin, like a membrane.
Mericarp, 242.
Mesocarp: see Endocarp.
Micropyle, 16, 211.
Mid rib, 168.
Mixed inflorescence, 192.
Monadelphous, 36, 40, 212.
Monandrous: with a single stamen.
Monocarpellary, 215.
Monochlamydeous: with only one set of floral envelopes.
Monocotyledonous, 118.
Monocotyledons, 118.
Monoecious, 68, 71.
Monomerous flowers, 196.
Monopodial branching, 112.
Morphology, 130.
Mucronate, 177
Multifid, 176.
Multilocular, 219.
Multiple fruits, 247.

Naked flowers: those which are destitute of calyx and corolla.
Naked seeds: those not enclosed in an ovary, 127
Napiform, 132.
Naturalized: introduced from other countries, but growing spontaneously from seed.
Nectary: that in which nectar is secreted, 88, 224
Needle-shaped, 122
Net veined, 1, 18.
Neutral flowers: those having neither stamens nor pistil.

Nodding: hanging with the top downward, like the flower in Fig. 82.

Node, 1.

Normal: regular; according to rule.

Nucleus (of an ovule), 16, 211, 219.

Nut, 211.

Nutlet: a small nut or nut-like body, 65.

Obcordate, 175.

Oblanceolate, 174.

Oblique: having the sides unequal.

Obliteration (of partitions), 220.

Oblong, Fig. 146.

Obovate, 174.

Obsolete, 206.

Obtuse, 177.

Ochrea: a tube formed by the union of both edges of a pair of stipules.

Ochreate: having ochreæ.

Octandrous: having eight separate stamens, 15.

Odd-pinnate, 189.

Offset: a short, prostrate branch, rooting at the end.

Opposite, 158.

Orbicular, Fig. 146.

Organs: the parts or members of a living body.

Organs of Reproduction: the part of the flower.

Organs of Vegetation: root, stem, and leaves.

Orthostichies, 160.

Orthotropous: applied to ovules when straight, so that the micropyle is as far as possible from the point of attachment, 246.

Outline of leaves, 171.

Oval, Fig. 146.

Ovary, 7, 25.

Ovate, Fig. 148.

Ovoid: egg-shaped.

Ovule, 7, 16.

Palate, 209.

Palet, 101.

Palmate, 168.

Palmately lobed, 176.

Palmatifid, 176.

Panicle, 106, 190.

Papilionaceous, 39.

Pappose, 206.

Pappus: a circle of bristles or hairs representing the limb of the calyx in flowers of the Composite Family, 62.

Parallel-veined: same as straight-veined, 83.

Parasites, 135, 156.

Parietal: on the walls, 221.

Parted: almost completely cut through.

Pectinate: pinnatifid with lobes like the teeth of a comb.

Pedate, Fig. 160.

Pedicel, 28, 58.

Pedunele, 5, 28.

Peltate, 126, 175.

Pentamerous flowers, 196.

Pentandrous: with five distinct stamens.

Pepo, 233.

Perennial: a plant which continues to grow year after year, 136.

Perfect: having both stamens and pistil.

Perfoliate, 179.

Perianth, 81, 90.

Pericarp, 229.

Perigynous, 40, 48, 213, 216.

Perisperm, 218.

Persistent, 31, 206.

Personate, 209.

Petal, 5, 207.

Petiolate: having petioles.

Petiole, 4.

Phanerogamous or Phenogamous, 129.

Phyllome, 225.

Phyllotaxis, 158.

Pilose: having long, soft hairs.

Pinna: a primary division of a pinnately-compound leaf.

Pinnate, 168.

Pinnately-lobed, 176.

Pinnatifid, 176.

Pinnule: a secondary division of a pinnately-compound leaf.

Pistil, 7, 43, 215.

Pistillate: having a pistil, 68, 70.

Pitcher-shaped (leaf), Fig. 169.

Placenta, 221.

Placentation, 221.

Plaited, 166, 210.

Plumose: feathery.

Plumule, 79, 147, 138, 252.

Pod: a dehiscent fruit, 25.

Pollen, 6, 46.

Pollen-masses, 92.

Pollen-tube, 46.

Pollination, 121, 247.

Pollinia: pollen masses, Fig. 93.

Polyadelphous, 40, 212.

Polyandrous: with numerous distinct stamens, 6, 21.

Polycarpellary, 215.

Polygamous: having perfect as well as imperfect flowers.

Polygamo-dioecious, 75.

Polypetalous: having separate petals, 5, 207.

Polyphyllous, 81.

Polysepalous: having separate sepals, 5, 205.

Pome, 53, 232.

Posterior: next the axis, 197.

Preflloration, see Æstivation.

Prefoliation: the disposition of leaves in the bud, 166.

Prickles, 227.

Primary roots, 132.

Primine, 214.

Procumbent: lying on the ground.

Prostrate, 149.

Pseudocarp, 236.

Pubescent: covered with fine down.

Punctate: having transparent dots, like the leaves of St. John's Wort.

Putamen, 54, 231.

Pyxis, 240.

Quinquefoliolate: having five leaflets, 180.

Raceme, 189.

Racemose: like a raceme, 143.

Radiate, 168.

Radical: pertaining to the root, 4, 13, 48, 60.

Radical leaves, 4, 28.

Radicle, 79, 147, 132, 252.

Ramification, 141.

Raphe, 216.

Ray: the marginal florets of a Compositæ flower, as distinguished from the disk.

Receptacle, 8.

Recurved: curved backwards.

Reduplication, 200.

Reflexed: bent backwards, 88.

Regular: with parts of the same size and shape, 5, 205, 207.

Reniform, Fig. 156.

Retuse: slightly notched at the apex.

Revolute: rolled back, 166.

Rhizome, 151.

Ringent, 209.

Root, 2, 13, 131.

Root-cap, 131.

Root-hairs, 131, 226.

Rootlet, 2.

Root-stock, 88, 151.

Rotate, 208.

Rudimentary: imperfectly developed.

Rugose: wrinkled.

Runcinate: with teeth pointing backwards, as in the leaf of the Dandelion, 176.

Runner, 131.

Sagittate, 28, 175.

Salver-shaped, Fig. 179.

Samara, Figs. 76, 208.

Saprophytes, 135, 156.
Sarcocarp: the flesh of a drupe.
Scabrous: rough.
Scales, 71, 121, 137, 191
Scandent: climbing
Scape, 19, 60, 88.
Scar, 88.
Schizocarp, 212.
Scion: a young shoot.
Scorpioid cyme, 114.
Secondary roots, 134.
Secundine, 214.
Seed, 12, 214.
Seed-leaves, 78.
Seed-vessel, see Ovary.
Self-fertilization, 88.
Sepal, 5, 205.
Septicidal (dehiscence): splitting open along the partitions, 239.
Septifragal, 239.
Septum: a partition.
Serrate, 178.
Sessile, 1, 28, 211.
Setaceous: like a bristle.
Sheath: a tube surrounding a stem, 103.
Sheathing: surrounding like a sheath.
Shield-shaped, see Peltate.
Shoot: a newly-formed branch.
Shrub, 118.
Silicle, 240.
Silique, 240.
Simple (leaves), 167; (pistil), 215.
Sinuate: wavy on the margin.
Solitary, 188.
Spadix, 97, 98, 189.
Spathe, 97, 98, 191.
Spathulate, 171.
Spermoderm, 249.
Spike, 100, 189.
Spikelet, a secondary spike, 106.
Spindle-shaped, 133.
Spine, 227.
Spur, 90, 209.
Stamen, 6, 13, 211.
Staminate (flower): having no pistil, but only stamens, 68, 70.
Staminode, 211.
Standard: the broad upper petal of a papilionaceous corolla.
Stem, 7, 13, 137.
Stemless, 18.
Sterile (flower): having no pistil, 68.
Stigma, 7.
Stigmatic: bearing the stigma.
Stinging-hairs, 226.
Stipulate: having stipules.
Stipule, 33, 181.
Stolon: a short branch which droops to the ground and takes root, 149.
Stone, see Putamen.
Stone-fruit: see Drupe.
Straight-veined, 83.
Strap-shaped, see Ligulate.
Striate: marked lengthwise with lines or furrows.
Strobile: same as Cone.
Style, 7.
Subulate, Fig. 117.
Succulent: juicy; fleshy.
Sucker: an underground branch, at length emerging and forming a stem.
Superior, 7, 11, 15, 49, 216.
Suppression: absence of parts.
Surface of leaves, 182.
Suspended: hung from above.
Suture, 217.
Symmetrical, 47, 201.
Sympodial, 117 115.
Syncarpous, 30, 215, 230.
Syngenesious, 60, 68, 212.

Tap root, 32, 132.
Teeth (of calyx), 31.
Tegmen, 249.
Tendril, 150.
Terete: cylindrical.
Terminal: at the end of a stem or branch, 44, 122, 149, 187.
Ternate: in threes.

Testa, 219.
Tetradynamous, 20, 211.
Tetramerous flowers, 196.
Tetrandrous: having four distinct stamens.
Thalamiflorous: having the stamens inserted on the receptacle.
Thalamus: the receptacle.
Thread-shaped, see Filiform.
Throat (of calyx), 206.
Thorn, see Spine.
Thyrse, 192
Tomentose: woolly.
Toothed, see Dentate, 112.
Torus: same as receptacle, 216.
Trailing, 149.
Tree, 148.
Tradelphous, 40, 212.
Triandrous: having three distinct stamens.
Trichomes, 131, 226.
Triennial: lasting three years.
Trifoliolate: having three leaflets, 180.
Trimerous flowers, 196.
Truncate, 177.
Trunk: the main stem.
Tube, 31, 128.
Tuber, 154.
Tuberous: like a tuber.
Tubular, 208.
Tunicated, 92.
Twining, 150.
Two-lipped, see Labiate.
Types, 27.
Umbel, 58, 189.
Umbellet: a secondary umbel.
Unguiculate: having a claw.
Unilocular, 219.
Valvate: edge to edge, but not overlapping, 38, 210.
Valve, 16.
Valved: having valves.
Veins: the finer parts of the framework of a leaf.
Venation, 168.
Ventral suture, 217.
Vernation, same as Prefoliation, 166.
Versatile, 162, 211.
Vertical leaves, 88, 157.
Verticillate, 158.
Verticillaster, 193.
Villose, 182.
Wavy: with alternate rounded hollows and projections, 178.
Wedge-shaped: like a wedge, the broad part being the apex.
Wheel-shaped, see Rotate.
Whorl: a circle of three or more leaves at the same node, 23, 120, 158.
Wing, 75, 121, 211.
Woody stems, 148.
Zygomorphic flowers, 203.

THE COMMONLY OCCURRING

FLOWERING PLANTS OF PRINCE EDWARD ISLAND

FOR THE USE OF BEGINNERS

BY

JOHN MacSWAIN

INSTRUCTOR OF DRAWING AND NATURAL HISTORY IN THE CITY SCHOOLS, CHARLOTTETOWN

PREFACE

THE catalogue used in this work was compiled from the "List of Prince Edward Island Plants by J. MacSwain and F. Bain, published by the Natural History Society of Prince Edward Island, July 1891"; and from later lists prepared by a few who are well known as Botanists, who collected plants and reported those discovered to the Provincial Secretary of the Botanical Club of Canada. Chief amongst those investigators of our Flora are Messrs. L. W. Watson, M.A., J. M. Duncan, J. T. Clarkin, B.A., A. Smallwood and the compiler.

In the preparation of this work I have made considerable use of Gray's Manual of the Botany of the Northern United States, taking especial care that the nomenclature of the revised edition of that popular and standard work should be given in this. I have also, in numerous cases, availed myself of the concise descriptions of Spotton's Botany. Both of these excellent manuals have been frequently and carefully consulted in the preparation of this small work on the plants of Prince Edward Island.

To Mr. J. T. Clarkin, as well as to Mr. L. W. Watson, I acknowledge my indebtedness for valuable suggestions and for their cheerfully rendered assistance in proof-reading.

There are no doubt errors of omission and perhaps other imperfections, for which indulgence is requested; but it is believed that every flowering plant, with the exceptions stated, are included here, unless a few which are extremely rare and local. It is now submitted with the hope that it will conduce to a greater interest in Botany, aid in a more general knowledge of our plants and promote the study of this valuable branch in our schools.

JOHN MACSWAIN.

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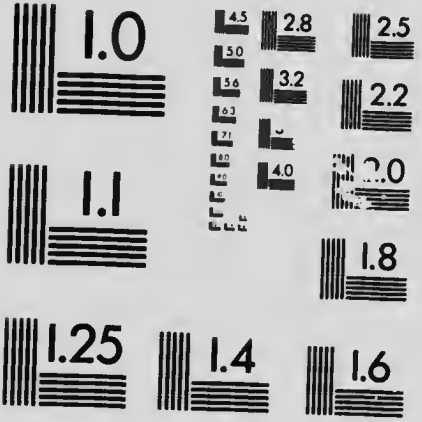

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ABBREVIATIONS OF THE NAMES OF BOTANISTS.

Cited as authorities in the following Flora:—

Ait.	for	Aiton.	L. or Lin.	for	Linnæus.
Bernh.	"	Bernhardi.	Lam.	"	Lamarck.
Bigel.	"	Bigelow.	Less.	"	Lessing.
DC.	"	De Candolle.	Lehm.	"	Lehmann.
Desf.	"	Desfontaine.	Michx.	"	Michaux.
Ehrh.	"	Ehrhart.	Mill.	"	Miller.
Ell.	"	Elliott.	Muhl.	"	Muhlenberg.
Engelm	"	Engelmann.	Nutt.	"	Nuttall.
Gært.	"	Gærtner.	R. Br.	"	Robert Brown.
Gr.	"	Gray.	Salisb.	"	Salisbury.
H. B. K.	"	Humboldt, Bonpland and Kunth.	Schwein.	"	Schweinitz.
			Scop.	"	Scopoli.
			Torr.	"	Torrey.
Hook.	"	Hooker.	Vent.	"	Ventenat.
Hoffm.	"	Hoffman.	Wang	"	Wangenheim.
Huds.	"	Hudson.	Willd.	"	Willdenow.

KEY TO THE ORDERS CONTAINED IN THIS WORK.

CLASS I. EXOGENOUS OR DICOTYLEDONOUS PLANTS.

SUB-CLASS I. ANGIOSPERMS.

DIVISION I. POLYPETALOUS PLANTS.

Calyx and corolla both present, the latter of separate petals.

A. Stamens more than 10.

* *Stamens hypogynous, that is, inserted on the receptacle.*

\+ *Pistils apocarpous, that is, separate or the carpels separate.*

Herbs. Leaves generally decompound or much dissected. — RANUNCULACEÆ 15

Stamens monadelphous. Ovaries in a ring. — MALVACEÆ .. 24

\+ \+ *Pistils syncarpous, that is, stigmas, styles, or cells more than one and united.*

Fruit a many-seeded berry; seeds in two parallel rows. Leaves compound. — Actæa in RANUNCULACEÆ 17

Aquatics. Leaves floating, large and deeply lobate. — NYMPHÆACEÆ 17

Bog plants. Leaves pitcher-shaped and hollow. — SARRACENIACEÆ 17

Stamens in 3 or 5 sets. Leaves transparent-dotted. — HYPERICACEÆ 23

* * *Stamens perigynous, that is, inserted on the calyx.*

Leaves alternate, with stipules. Fruit apocarpous, or a drupe, or pome.—ROSACEÆ..... 28

B. Stamens not more than 10.

* *Stamens just as many as the petals, one stamen in front of each petal.*

Stamens 5, opposite the petals. Sepals 2; leaves fleshy.—PORTULACACEÆ 23

Herbs, with regular pentamerous flowers. 5 stamens opposite the petals of the corollas, and 1-celled, 1-seeded ovaries.—PLUMBAGINACEÆ.... 56

Sometimes polypetalous. Flowers yellow, in axillary spikes, the petals sprinkled with purplish dots.—Lysimachia in PRIMULACEÆ..... 56

* * *Stamens as many as the petals and alternate with them, or not exactly of the same number.*

\+ *Corolla irregular.*

Corolla flattened and closed. Stamens 6, in 2 sets. Corolla 1 or 2-spurred.—FUMARIACEÆ... 17

Stamens 5. Corolla 1-spurred—VIOLACEÆ..... 19

Herbs chiefly with perfect and generally symmetrical hypogynous flowers, the stamens 5 or 10, as many or twice as many as the sepals.—GERANIACEÆ..... 24

Corolla mostly papilionaceous. Stamens diadelphous. Filaments often united. Ovary simple. Leaves compound.—LEGUMINOSÆ... 26

\+ \+ *Corolla regular, or nearly so.*

1. Calyx superior, or wholly or partly adherent to the ovary.

(*a*) *Stamens perigynous, that is, inserted on the calyx.*

Shrubs. Stamens occasionally from 5 to 10 only. Leaves alternate, with stipules. Fruit drupe-like, containing 1–5 bony nutlets.—Crataegus in ROSACEÆ..... 32

Leaves opposite or alternate, without stipules. Styles or stigmas 2. Stamens 5 or 10.—SAXIFRAGACEÆ... 33

Aquatic herbs. Stamens 4–8. Stigmas 4. HALORAGEÆ. 34
Flowers symmetrical. Stamens 2, 4, or 8. Stigmas 2, 4, or capitate. —CUCURBITACEÆ. 35

(*b*) *Stamens epigynous: on the ovary, or on a disk which covers the ovary.*

Flowers chiefly in compound umbels. Calyx minute. Stamens 5. Styles 2. Fruit 2-seeded. —UMBELLIFERÆ. 36
Umbels not compound. Stamens 5. Styles usually more than 2.—ARALIACEÆ. 38
Flowers in cymes or heads. Stamens 4. Style 1. Fruit a 1–2 seeded drupe.—CORNACEÆ. 38

2. Calyx inferior, that is, free from the ovary.

(*a*) *Stamens hypogynous, that is, on the receptacle.*

Petals 4. Stamens 6, tetradynamous. Fruit a silique or silicle.—CRUCIFERÆ. 18
Petals 3. Sepals 3 or 5, external ones smaller. Stamens few or many. Leaves simple, mostly entire.—CISTACEÆ. 19
Bog herbs. Leaves radical and clothed with glandular reddish hairs. Flowers pentamerous in a 1-seeded raceme, white.—DROSERACEÆ. 34
Stamens 9 in 3 sets. Leaves with transparent dots.—Elodes in HYPERICACEÆ. 24
Styles 2–5. Stamens no more than twice as many as the sepals. Stems swollen at the joints. Leaves opposite or whorled, entire.—CARYOPHYLLACEÆ. 21
Anthers opening by pores at the top, or across the top. Leaves mostly green, sometimes brown, sometimes white or tawny. Some polypetalous.—ERICACEÆ. 55

(*b*) *Stamens perigynous, that is, attached to the calyx.*

Herbs or shrubs. Leaves opposite or alternate, without stipules. Styles 2. Stamens and petals on the calyx.—SAXIFRAGACEÆ. 33

Succulent herbs with symmetrical flowers. Sepals, petals and pistils equal in number. The stamens as many, or twice as many.—CRASSULACEÆ. 34

(*c*) *Stamens 5, inserted under the edge of a flattened disk in the bottom of the calyx tube.*

Trees or shrubs, with simple or compound leaves. Fruit a double samara. Shrubs or trees. Stamens 5 10. —SAPINDACEÆ. 25

(*d*) *Stamens attached to the base of the petals.*

Shrubs with axillary flowers. The stamens as many as the divisions of the almost or quite 4-8 petalled corolla and alternate with them.—ILICINEÆ. 25

DIVISION II. GAMOPETALOUS PLANTS.

Calyx and corolla present, the latter of united petals.

A. Calyx superior, that is, adherent to the ovary.

Stamens united by their anthers.

Flowers in heads, surrounded by an involucre.—COMPOSITÆ 40

Flowers not in heads. Corolla split down one side. Stamens 5, commonly monadelphous.—LOBELIACEÆ. 51

* * *Stamens not united in any way.*

\+ *Stamens on the tube of the corolla.*

Leaves when opposite, stipulate; when whorled, exstipulate.—RUBIACEÆ. 40

Leaves opposite, without stipules. Calyx adherent to the ovary. Corolla on the ovary. Stamens on the tube of the corolla. Shrubs or herbs.—CAPRIFOLIACEÆ. . 39

\+ \+ *Stamens not on the corolla.*

Shrubby plants chiefly, or parasites. Stamens as many or twice as many as the lobes of the corolla.—ERICACEÆ. 52

B. Calyx inferior, that is, free from the ovary.

* *Stamens more than the lobes of the corolla.*

Chiefly shrubby plants, with simple entire leaves. Stamens twice as many as the lobes of the corolla. ERICACEÆ. 52

Filaments monadelphous. Carpels in a ring. MALVACEÆ. 24

Ovary 1-celled, with 1 parietal placenta. Stamens mostly diadelphous.—LEGUMINOSÆ. 26

* * *Stamens just as many as the lobes of the corolla, one in front of each lobe.*

Stamens on the corolla. Style 1. Ovary 1-celled, with a free central placenta.—PRIMULACEÆ 56

Styles 5. Stamens 5. Ovary 1-celled and 1-seeded.—PLUMBAGINACEÆ. 56

* * * *Stamens as many as the lobes of the corolla, inserted on its tube, alternately with its lobes.*

\+ *Ovaries 2, separate.*

Plants with milky juice. Anthers converging round the stigmas, but not adherent to them. Filaments distinct.—APOCYNACEÆ. 57

\+ \+ *Ovary 4-lobed around the base of the style.*

Stamens 4. Leaves opposite, aromatic.—Mentha in LABIATÆ. 61

Stamens 5. Leaves alternate.—BORRAGINACEÆ. 58

\+ \+ \+ *Ovary with 2 or more cells.*

Corolla almost if not quite polypetalous. Fruit a red berry-like drupe.—ILICINEÆ. 25

Stamens 4. Flowers in a close spike. Chiefly stemless herbs.—PLANTAGINACEÆ. 63

Twining or trailing herbs with alternate leaves. Stamens 5. Style 2-cleft.—CONVOLVULACEÆ. 58

Rank-scented herbs with alternate leaves, pentamerous and pentandrous flowers. Fruit a berry or pod.—SOLANACEÆ. 58

+ + + + *Stamens fewer than the lobes of the corolla; the corolla mostly irregular or 2-lipped.*

Ovary 4-lobed around the style. Stamens 4, didynamous, or sometimes 2 with anthers.—LABIATÆ 61

Corolla more or less irregular. Stamens 5 or 4, didynamous, or only 2.—SCROPHULARIACEÆ..... 59

Corolla almost regular. Flowers in a terminal spike.—Verbascum in SCROPHULARIACEÆ..... 59

DIVISION III. APETALOUS PLANTS.

Corolla, and sometimes calyx, wanting.

A. Flowers not monœcious.

* *Calyx superior, that is, adherent to the ovary.*

Small smooth herbs, with greenish-yellow flowers. Stamens twice as many as the calyx-lobes.—SAXIFRAGACEÆ..... 33

Aquatics. Leaves finely dissected or linear. Stamens 1-8. Ovary 3-4-lobed or 1-celled.—HALORAGEÆ.... 34

Herbs with symmetrical flowers, the parts in 2's or 4's. Style 1. Stamens 4. Ovary 4-celled, 4-sided.—ONAGRACEÆ..... 35

* * *Calyx inferior, that is, free from the ovary.*

+ *Ovaries more than one and separate from each other.*

Calyx present, colored and petal-like.—RANUNCULACEÆ.. 15

+ + *Ovary only one, but with more than one cell, except in* Glaux.

Succulent herbs, in wet places. Flowers symmetrical. Pod 5-celled, 5-horned.—CRASSULACEÆ..... 34

Herbs. Ovary 3-celled, 3-lobed and protruded on a long pedicel. Juice milky.—EUPHORBIACEÆ..... 69

Trees. Ovary 2-celled and 2-lobed. Fruit 2 1-seeded samaras joined together.—SAPINDACEÆ..... 25

Trees, with simple leaves. Fruit a samara winged all round and 1-seeded. Stigmas 2.—URTICACEÆ..... 70

Low shrubby evergreens with heath-like leaves.—EMPETRACEÆ..... 73

Herbs. Ovary 1-celled, the placenta central. A marsh plant.—Glaux in PRIMULACEÆ..... 57

+ + + Ovary only one, 1-celled and 1-seeded.

Joints swollen. Sheaths membranous. Calyx 4-6 parted. Leaves alternate, entire.—POLYGONACEÆ..... 66

Herbs, armed with stinging hairs. Flowers in spikes or racemes. Stamens as many as the sepals. Style 1. Fruit an achene.—URTICACEÆ..... 70

Herbs, with mostly opposite and entire leaves a 4-5 parted herbaceous calyx. Sepals 5. Styles 2. Stamens perigynous.—ILLECEBRACEÆ..... 64

Homely herbs, the flowers mostly imbricated with dry and scarious bracts, which are commonly 3 and colored.—AMARANTACEÆ..... 65

Chiefly homely herbs, with alternate leaves, no stipules, minute greenish flowers; the 1-celled ovary becoming a 1-seeded utricle, or an achene.—CHENOPODIACEÆ..... 65

Plants, with a milky, acrid juice, monœcious, achlamydeous, greenish flowers, both contained in the same cup-shaped involucre.—EUPHORBIACEÆ..... 69

Trees. Leaves pinnately compound. Fruit a 1-seeded samara, wing oblong.—ACERACEÆ..... 57

B. Flowers in catkins, monœcious or diœcious.

** Sterile flowers only in catkins.*

Leaves simple. Fertile flowers, 1-3 in an involucre or cup.—CUPULIFERÆ..... 71

** * Both sterile and fertile flowers in catkins.*

Leaves simple, alternate. Seeds with a downy tuft at one end.—SALICACEÆ..... 72

Fertile flowers, 2 or 3 at each scale of the catkin.—CUPULIFERÆ..... 71

Fertile flowers, single, under each scale. Nutlets naked, waxy-coated, or drupe-like.—MYRICACEÆ..... 70

SUB-CLASS II. GYMNOSPERMÆ.

Pistil an open scale, or altered leaf, bearing naked ovules on its margin, or in Taxus entirely wanting.—CONIFERÆ..... 74

CLASS II. ENDOGENOUS OR MONOCOTYLEDONOUS PLANTS.

Leaves parallel-veined, but net-veined in Arisæma, Trillium and Medeola; the parts of the flower mostly in threes, never in fives. Wood of the stem in separate bundles throughout the cellular tissue.

PETALOIDEOUS DIVISION.

Flowers not on a spadix, but furnished with a corolla-like or herbaceous perianth.

* *Perianth superior. Flowers perfect.*

Flowers irregular. Stamens 1 or 2, gynandrous.—ORCHIDACEÆ..... 75

Stamens 3. Anthers extrorse, opening lengthwise. Flowers regular.—IRIDACEÆ..... 78

* * *Perianth inferior.*

Pistils numerous or few, in a head or ring.—ALISMACEÆ. 82

Perianth of similar divisions, or lobes mostly colored.—LILIACEÆ..... 78

Perianth of 3 green sepals and 3 colored petals.—Trillium in LILIACEÆ..... 78

Perianth glumaceous, of 6 similar divisions. Stamens 6 or 3. Style 1.—JUNCACEÆ..... 80

SPADICEOUS DIVISION.

Flowers on a spadix, with or without a spathe.

Little floating aquatics, with no distinction of stem and foliage.—LEMNACEÆ..... 82

Immersed aquatics, branching and leafy. NAIADACEÆ. 83

Reed-like marsh herbs, with linear, sessile leaves. Flowers without floral envelopes, in spikes or heads; monœcious.—TYPHACEÆ. 81

Flowers perfect, on a lateral spadix. Sepals 6.—Acorns in ARACEÆ. 81

Terrestrial or marsh plants. Leaves mostly with a distinct net-veined blade. Petioled.—ARACEÆ. 81

DIVISION IV. CRYPTOGAMOUS PLANTS.

PTERIDOPHYTES.

Spores of one kind, in sporangia borne on the back or margin of fronds, circinate in vernation.—FILICES. . 84

Sporangia bivalvular, frond erect in vernation, not circinate.—OPHIOGLOSSACEÆ 88

THE COMMONLY OCCURRING

WILD PLANTS OF PRINCE EDWARD ISLAND

PHANEROGAMS OR FLOWERING PLANTS

CLASS I. EXOGENS OR DICOTYLEDONS.

SUB-CLASS I. ANGIOSPERMS

I. POLYPETALOUS DIVISION.

Plants with flowers having the petals of the corolla separate.

ORDER I. RANUNCULACEÆ. (CROWFOOT FAMILY.)

Herbs with an acrid, colourless juice; stamens numerous, leaves exstipulate and generally dissected. The sepals, petals, stamens and pistils free or separate. Petals sometimes wanting.

Thalictrum. Sepals 4-5, petal-like or greenish. Petals none. Leaves alternate, 2-3 ternately compound.

1. **T. Polyg'anum,** Muhl. (TALL MEADOW-RUE.) Smooth, 4-8 ft. high, stem leaves sessile. Leaflets roundish to oblong, mucronate. Flowers white in compound panicles, fertile ones with some stamens.—Along rivulets.

Ranun'culus. Sepals 5; petals usually 5 with a little pit or scale at the base inside, achenes numerous, in a head. Flowers generally yellow.

2. **R. aquat'ilis,** L., var. **tricophyl'lus,** Gray. (COMMON WHITE WATER-CROWFOOT.) The filiform foliage under water. Flowers white, floating.

3. **R. Cymbala'ria,** Pursh. (SEA-SIDE CROWFOOT.) Glabrous, low, spreading, rooting at the joints. The fleshy leaves long-petioled, round and crenate. Yellow petals 5-8.

4. **R. Multif'idus,** Pursh. (YELLOW WATER-CROWFOOT.) Stems floating or immersed with the leaves repeatedly 3 forked; other leaves wedge-shaped or kidney-shaped. Petals 5-8, much larger than the calyx.

5. **R. aborti'vus,** L. (SMALL-FLOWERED C.) Branching 6-24 in. high. Petals shorter than the reflexed calyx. Radical leaves round and petioled; stem leaves 3-5 parted, sessile. Stem slender, smooth.

6. **R. sceleratus,** L. (CURSED C.) Stem thick, hollow, smooth. Radical leaves 3-lobed, stem leaves 3-parted. Petals no longer than the calyx. Juice blistering.—Wet places.

7. **R. repens,** L. (CREEPING C.) Leaves often blotched with white. Petals longer than the calyx. Peduncles furrowed. Styles stigmatic along inner side.

8. **R. bulbo'sus,** L. (BULBOUS C. OR BUTTERCUP.) A bulb at the base of the stem, peduncles furrowed. Stem hairy, 12 inches high.

9. **R. acris,** L. (TALL BUTTERCUP.) No bulb, no furrowed peduncles. Petals much longer than calyx. Stem hairy, erect, 2-3 feet high.—Fields. Very common.

Cal'tha. Sepals 5-9, petal-like. Petals none. Pods (follicles) compressed.

10. **C. palu'stris,** L. (MARSH MARIGOLD.) Stem hollow, furrowed; leaves round or kidney-shaped, crenate or dentate. Sepals broadly oval, golden-yellow.—Early spring in wet meadows, along streams.

Coptis. Sepals 5-7, petal like, deciduous, petals 5-7, small and club-shaped.

11. **C. trifo'lia,** Salisb. (THREE-LEAVED GOLDTHREAD.) Leaflets 3, obovate wedge-form, sharply toothed. Scape 1-flowered. Root bright yellow, bitter.

Actæ'a. Sepals 4-5, falling when the flower expands. Petals 4-10, small, flat, on slender claws. Stamens with white filaments. Seeds packed horizontally in 2 rows. Leaves 2-3, ternately compound. Flowers, white.

12. **A. spica'ta,** L., var. **rubra,** Ait. (RED BANEBERRY.) Raceme, ovate, petals shorter than the stamens. Berries red.

13. **A. alba,** Bigel. (WHITE BANEBERRY.) Raceme longer than broad, pedicels reddish; berries white.

ORDER II. **NYMPHÆA'CEÆ.** (WATER-LILY FAMILY.)

Aquatic herbs with peltate or sometimes only cordate leaves, floating or emersed. Flowers axillary and solitary.

Nu'phar. Sepals 5-6 or more, colored or partly green outside, roundish, concave.

N. ad'vena, Ait. f. (YELLOW POND-LILY.) Sepals 6, unequal; petals shorter than the stamens, small. In stagnant water.

ORDER III. **SARRACENIA'CEÆ.** (PITCHER-PLANT F.)

Bog plants with hollow pitcher-form or trumpet-shaped leaves.

Sarrace'nia purpu'rea, L. (PITCHER PLANT.) Leaves hollow, with a wing on one side, purple-veined, curved. Flower deep purple.

ORDER IV. **FUMARIA'CEÆ.** (FUMITORY FAMILY.)

Smooth herbs, with brittle stems, dissected leaves and irregular flowers. Sepals 2, very small. Corolla of 4 petals, flattened, the two inner united by their tips; 6 diadelphous stamens.

1. **Dicen'tra cucullaria,** DC. (DUTCHMAN'S BREECHES.) Leaves radical, finely cut. Raceme, few flowered, corolla with 2 divergent spurs. Flowers white, tipped with cream color.

2. **Coryd'alis glauca,** Pursh. (PALE CORYDALIS.) Stem 1-4 feet high; flowers in compound racemes, purplish, tipped with yellow. Corolla 1-spurred.

ORDER V. **CRUCIF'ERÆ.** (MUSTARD FAMILY.)

Herbs with a pungent watery juice, alternate leaves without stipules, and regular flowers in racemes or corymbs. Fruit a silique or silicle. Flowers cruciform, tetradynamous.

* *Pod a silique.*

1. **Cardam'ine hirsu'ta,** L. (SMALL BITTER CRESS.) Leaves pinnate, leaflets 5-11, terminal one largest. Pods linear. Flowers white, small.—Wet places.

2. **Nastur'tium officina'le,** R. Br. (WATER CRESS.) Stems spreading and rooting; leaves, pinnate 3-11, oblong, nearly entire leaflets. Petals white, twice the length of the calyx.

3. **N. Armora'cia,** Fries. (HORSERADISH.) Flowers white. Root-leaves very large, oblong, and generally crenate; stem-leaves lanceolate. Roots very large.

4. **Barbare'a vulga'ris,** R. Br., var. **stricta.** (COMMON WINTER CRESS.) Lower leaves lyrate, 1-5 pairs of lateral ones sometimes absent, pods linear appressed.

5. **Sisym'brium officin'ale,** Scop. (HEDGE MUSTARD.) Leaves runcinate, the small flowers pale yellow. Pods awl-shaped, close-pressed to the stem, 2-3 feet high.—Waste places.

6. **Bras'sica Sinapi'strum,** Bois. (CHARLOCK.) With knotty and beaked pods, flowers yellow; lower leaves lyrate, incised or pinnatifid; upper, barely toothed.—Often in grain fields.

7. **B. nigra,** Koch. (BLACK MUSTARD.) Pods smooth, half inch long, 4-cornered, the valves 1-nerved, erect on appressed pedicels, forming a slender raceme, tipped with a stout style.

* * *Pods, short; a silicle.*

8. **Capsel'la Bursa-pasto'ris,** Moench. (SHEPHERD'S PURSE.) Pod obcordate-triangular, flattened contrary to the narrow partition; flowers small, white, root-leaves clustered, pinnatifid or toothed, stem-leaves arrow-shaped, sessile.

9. **Lepi'dium Virgi'nicum,** L. (WILD PEPPERGRASS.) Seed minutely margined; pod marginless or obscurely margined at the top. Flowers small, white or greenish. Stamens, 2. Pod 2-seeded. Common about the wharves in Charlottetown.

10. **Caki'le America'na,** Nutt. (SEA-ROCKET.) Pod 2, jointed across, fleshy; flowers purplish; leaves obovate, sinuate and toothed.—Sea-coast.

ORDER VI. CISTA'CEÆ. (ROCK-ROSE FAMILY.)

Low shrubs or herbs, with simple entire leaves and regular flowers. Sepals 5, 2 much smaller; petals 3 or 5.

1. **Hudso'nia tomento'sa,** Nutt. (DOWNY HUDSONIA.) Hoary with down; leaves oval or narrowly oblong, one inch long, close-pressed or imbricated. Flowers sessile, or short peduncled, yellow.

2. **Lechea minor,** L. (SMALL PINWEED.) Flowers small, purplish, racemed; stem slender; leaves linear, petals 3. One foot high. Looks like the sorrel.—Dry and sterile ground.

ORDER VII. VIOLA'CEÆ.

Genus—Viola.

This genus has been the subject of much study for some years. New forms have been recognized, species sub-divided, and many new species proposed. The whole subject is still unsettled. In the meantime the following species constitute a representative list of the violets to be found in this province. Although the distinguishing specific characters of the Violets are most marked during the summer, when the cleistogamous flowers have appeared and the plants are in fruit, it is nevertheless deemed expedient for the purpose of the present work to describe the species in their vernal dress.

(1) **Stemless Violets:** leaves and scapes all from root stocks.

(A) FLOWERS WHITE.

1. **V. blanda,** Willd. (SWEET WHITE VIOLET.) Plant glabrate, leaves light green, cordate. Flowers small, lower

and lateral petals streaked with purple. Plant small, flowering early.—Damp meadows.

2. **V. alsophila,** Greene. (WHITE WOOD VIOLET.) Plant stoloniferous. Leaves somewhat pubescent, bright green above, paler beneath. Flowers somewhat larger and appearing later than those of V. blanda. Petals smooth, beardless, narrow, upper pair twisted.—Woods.

3. **V. Watsoni,** Greene. (WATSON'S VIOLET.) A near relative of the next species. Herbage resembles that of V. blanda. Flowers white or possibly faintly tinted; very large—an inch in diameter, on scapes, rising high above the leaves. Petals strap-like, much twisted. Bog meadows.

(B) FLOWERS VIOLET.

4. **V. palmata,** L. Var. **cucullata,** Gray. (EARLY BLUE VIOLET.) Leaves cordate, crenate, cucullate when young. Flowers violet, spurred petal beardless.—Low damp grounds.

5. **V. nesiotica,** Greene. (THE ISLAND VIOLET.) Tufted, low, sparsely pubescent. Leaves cordate, under-surface pale. Flowers deep violet; spurred petal bearded.—Woods and roadsides.

6. **V. Selkirkii,** Pursh. (SELKIRK'S VIOLET.) Plant stoloniferous, small, delicate. Leaves broadly ovate, crenate, dark green. Flower light-blue purple. Petals beardless. Spur large, thickened at end.—Damp shady places.

(2) **Leafy-Stemmed Violets.** *Flowers axillary.*

(C) FLOWERS YELLOW.

7. **V. pubescens,** Ait. Plant downy, 6–12 in. high. Leaves broadly cordate, coarsely serrate. Stipules entire.—Near Alberton.

(D) FLOWERS LIGHT BLUE-PURPLE.

8. **V. Labradorica,** Schr. (AMERICAN DOG VIOLET.) Stems tufted, glabrous, leafy. Leaf blades cordate; petioles slender. Stipules entire or serrate. Lateral petals slightly bearded.

(E) FLOWERS VARI-COLORED.

9. **V. tricolor,** L. (HEARTSEASE.) Stem branched. Stipules

large, laciniate. Flowers variously marked: yellow, purple, white. Waste places. Escaped.

NOTE. A special study of our violets was made by Mr. L. W. Watson. The genus, **Viola,** as given here, is the result of his study, and the descriptions were written by him.

ORDER VIII. **CARYOPHYLLA'CEÆ.** (PINK FAMILY.)

Herbs with opposite entire leaves, symmetrical flowers with or without petals; the stamens no more than twice the number of the sepals, hypogynous or perigynous; styles 2-5. Stems swollen at the joints.

Sepals united into a tube or cup.

1. **Sile'ne Cucu'balus,** Wibel. (BLADDER CAMPION.) Very smooth; leaves ovate-lanceolate, calyx, globular, much inflated, purple veined, petals 2-cleft; styles 3. A foot high.

2. **Lychnis Githa'go,** Lam. (CORN COCKLE.) Plant clothed with long soft hairs; calyx lobes 5, longer than the purple petals. Styles 5 or 4. — In wheat fields.

Sepals separate to the base.

Arena'ria. Sepals 5, petals 5, entire or notched, styles 3, stamens 10.

3. **A. serpyllifo'lia,** L. (THYME-LEAVED SANDWORT.) Branched 2-6 inches high. Leaves small, ovate, acute; the white petals hardly as long as the sepals which are 3 to 5 nerved.

4. **A. laterifl'ora,** L. Parts of the flower sometimes in 4's; sparingly branched, minutely pubescent; leaves oval or oblong, obtuse, ½-1 inch long; peduncles usually 2-flowered, becoming lateral; sepals oblong, obtuse.

5. **A. peploi'des,** L. Stems simple or forking; 6-10 inches high. Leaves ovate, fleshy, clasping. Flowers almost sessile in the axils. Sandy shores.

Stella'ria. Sepals and petals 4-5; petals deeply 4-, sometimes none. Styles 3, 4 or 5 opposite as many sepals.

6. **S. me'dia,** Smith. (COMMON CHICKWEED.) Marked longitudinally by 1 or 2 pubescent lines. Petals shorter than calyx.

7. **S. longifo'lia,** Muhl. (LONG-LEAVED STITCHWORT.) Stems branching, supported on other plants. Leaves linear. Pedicels of the flower long and slender. White petals 2-parted, longer than the 3-nerved sepals.

8. **S. lon'gipes,** Goldie. (LONG-STALKED S.) The rigid leaves lanceolate and acute, broadest at the base. The long pedicels scaly-bracted. Petals longer than the sepals. Seeds smooth.

9. **S. gramin'ea,** L. Resembling the last. Leaves linear-lanceolate, broadest above the base, pedicels widely spreading. Seeds strongly rugose.

Cera'stium. Sepals 5, rarely 4. Petals as many, usually 2-lobed; stamens, twice as many or fewer. Styles in number equal to the sepals and opposite them. Flowers white in terminal cymes.

10. **C. visco'sum,** L. (MOUSE-EAR CHICKWEED.) Stem hairy and clammy, ascending. Leaves ovate or obovate, obtuse. Flowers small in close clusters. Pedicels not longer than the sepals; petals shorter than calyx, 4–9 in. high.

11. **C. vulga'tum,** L. (LARGER MOUSE-EAR C.) Stems hairy, viscid; leaves lanceolate-oblong, acute. Pedicels longer than the sepals. Petals equalling the calyx.—Common.

12. **C. arven'se,** L. (FIELD C.) Stems ascending or erect, tufted, nearly smooth, slender, 4–8 inches high; leaves linear or linear-lanceolate, often fascicled in the axils. Petals obcordate, more than twice as long as the calyx.

Sagi'na. Sepals 4 or 5; petals 4 or 5, entire; styles as many as the sepals and alternate with them. Little matted herbs with thread-like or awl-shaped leaves.

13. **S. procumbens,** L. (PEARLWORT.) Matted with narrowly-linear leaves. Flowers small, parts mostly in 4's. Petals shorter than the ovate, obtuse sepals or none. Top of peduncle often bent into a hook.—Damp places.

14. **S. nodo'sa,** Fenzl. Low and tufted. Stems ascending, 3–5 inches high; lower leaves thread-form; upper awl-shaped, with minute ones fascicled in their axils so that the branchlets appear knotty. Petals much longer than calyx.—Wet sandy soil.

Buda. Sepals 5, petals 5, stamens 2-10. Styles and valves of the many-seeded pod 3, rarely 5. Low herbs of the sea-coast or sandy roads. Leaves filiform, somewhat fleshy.

15. **Buda ru'bra,** Dumort. (SAND SPURREY.) The summit of the prostrate or ascending stems, peduncles and sepals usually glandular-pubescent; leaves linear, flat, scarcely fleshy, stipules lanceolate. Calyx longer than the pink-red corolla.

Spergula. Stamens 5 or 10, styles 5. Five valves of the pod opposite the sepals. Leaves in whorls.

16. **Sper'gula arven'sis,** L. (CORN SPURREY.) Leaves numerous in whorls, thread-shaped, 1-2 inches long. Stipules minute; flowers white.—In grain fields.

ORDER IX. **PORTULACACEÆ.** (PURSLANE FAMILY.)

Herbs with succulent leaves and regular but unsymmetrical flowers, viz., sepals fewer than the petals. Sepals 2, petals 5, sometimes none. Stamens 5-20. Pod 1-celled.

Claytonia. Stamens as many as the hypogynous petals and attached to their base. Pod 3-6 seeded.

C. Caroliniana, Michx. (SPRING-BEAUTY.) Leaves ovate-lanceolate, 1-2 in. long. Corolla rose-colored, with deeper veins. Flowers in a raceme. Stem from a small tuber bearing a pair of opposite leaves.—At Wheatley River.

ORDER X. **HYPERICA'CEÆ.** (ST. JOHN'S-WORT FAMILY.)

Herbs or shrubs, with opposite, entire, dotted leaves and no stipules; regular hypogynous yellow flowers. Many or few stamens commonly collected in 3 or more clusters. Sepals 4-5; petals 4-5.

Hyperi'cum. Sepals and petals 5, stamens clustered in 3-5 sets.

1. **H. perfora'tum,** L. (COMMON ST. JOHN'S WORT.) Stem producing runners at the base, slightly 2-edged. Leaves linear-oblong with transparent dots; petals with black dots.

2. **H. mu'tilum,** L. Stem flaccid, widely branching, 6-20 in. high, leaves ovate or narrowly oblong, obtuse, partly clasping, 5-nerved. Pods ovate-conical, longer than the calyx. —Low grounds.

3. **H. Canaden'se,** L. (CANADA ST. JOHN'S WORT.) Stem 6-15 inches high. Leaves linear or linear lanceolate, 3 nerved at the base. Flowers small. Wet sandy places.

4. **Elo'des campanula'ta,** Pursh. (MARSH ST. JOHN'S WORT.) Sepals 5, petals 5, oblong. Stamens 9, united in 3 sets; sets separated by glands. Leaves closely sessile or clasping by a broad base, oblong or ovate, obtuse; 1-2 feet high. Common in swamps.

ORDER XI. MALVA'CEÆ. (MALLOW FAMILY.)

Herbs, with palmately-veined, alternate leaves with stipules. Flowers regular; sepals and petals 5 each. Stamens numerous, monadelphous, hypogynous. Anthers 1-celled.

Mal'va moscha'ta, L. (MUSK MALLOW.) Stem 1 foot high. Leaves 5-parted, the divisions cleft. Flowers rose-colored or white, large, on short peduncles. Near gardens.

ORDER XII. GERANIA'CEÆ. (GERANIUM FAMILY.)

Plants with perfect and generally symmetrical hypogynous flowers; stamens as many or twice as many, and the lobes of the ovary as many as the sepals. Leaves not punctate.

Ox'alis. Sepals, petals and styles 5. Stamens 10, alternately shorter. Herbs with sour watery juice; leaves of 3 obcordate leaflets.

1. **O. acetosel'la,** L. (COMMON WOOD-SORREL.) Scape 1-flowered; petals white with reddish veins.

2. **O. cornicula'ta,** L., var. **stricta,** SAV. (YELLOW WOOD-SORREL.) Stipules, round or truncate ciliate. Peduncles 2-6 flowered, longer than the leaves.

Impa'tiens. Calyx and corolla colored alike. One sepal notched at the apex, another, the largest, forming a spurred sac. Petals 2 unequal sided and 2-lobed; stamens 5.

3. **I. pal'lida,** Nutt. (PALE JEWEL-WEED.) Flowers pale yellow; spotted with brownish-red. Sac obtuse, broader than long.

4. **I. fulva,** Nutt. (SPOTTED JEWEL-WEED.) Flowers orange-color, thickly spotted with reddish-brown. Sac longer than

broad. Plant 2-4 feet high. Both dewel weeds are found along streams.

Order XIII. **ILICI'NEÆ.** (Holly Family.)

Trees or shrubs with small axillary 4-8-merous flowers, a minute calyx free from the 4-8-celled ovary. Stamens as many as the divisions of the corolla, and alternate with them. Stigmas 4-8 or united into one, nearly sessile. Flowers white or greenish; leaves simple, mostly alternate.

Ilex. Petals oval or obovate; pedicels clustered mostly; flowers polygamous.

1. **I. verticilla'ta,** Gray. (Black Alder, Winterberry.) A shrub with the greenish flowers in sessile clusters or the fertile ones solitary. Fruit bright red; leaves alternate, obovate, oval or wedge-lanceolate, pointed, veiny, serrate.—Swamps.

Petals linear; pedicels solitary.

2. **Nemopan'thes fascicula'ris,** Raf. (Mountain Holly.) Flowers polygamo-dioecious. Calyx in sterile flowers of 4-5 minute deciduous teeth; in the fertile ones obsolete. Petals 4-5 oblong-linear, distinct. Branching shrub with ashy-gray bark; alternate and oblong leaves on slender petioles.

Order XIV. **SAPINDA'CEÆ.** (Soapberry Family.)

Trees or shrubs, with simple or compound leaves; mostly unsymmetrical and often irregular flowers; the 5-10 stamens inserted on a fleshy disk.

Acer. Flowers polygamo-dioecious. Calyx colored, usually 5-lobed. Petals none or as many as the lobes of the calyx; stamens 3-12. The 1-seeded samaras united in pairs.

1. **A. Pennsylva'nicum,** L. (Striped Maple.) Leaves 3-lobed at the apex, finely and sharply doubly serrate, the lobes taper-pointed and serrate. Racemes drooping, terminal. The greenish bark striped with dark lines. Small and slender.

2. **A. spica'tum,** Lam. (Mountain M.) A tall shrub. Leaves 3-lobed, coarsely serrate. Racemes upright, dense. Petals linear-spatulate.

3. **A. saccharī'num,** Wang. (SUGAR or ROCK M.) A large tree with 3-5 lobed leaves, breadth and length the same with rounded sinuses, lobes sparingly toothed. Flowers on drooping, slender pedicels; petals none.

4. **A. dasycar'pum,** Ehrh. (WHITE or SILVER M.) Leaves deeply 5-lobed, divisions narrow, sharply toothed, silvery-white underneath. Flowers in erect greenish-yellow clusters; petals none.

5. **A. ru'brum,** L. (RED or SWAMP M.) Leaves 3-5 lobed, the sinuses acute; lobes serrate and notched, acute. Flowers scarlet, crimson or yellowish on very short pedicels; petals linear-oblong. Twigs reddish, leaves turning crimson in autumn.

6. **Negun'do acero'ides,** Moench. (ASH-LEAVED M. BOX-ELDER.) Leaves pinnate of 3-5 leaflets, ovate, pointed, toothed. Stamens 4-5. Sterile flowers in dense clusters; the pistillate ones in drooping racemes.

ORDER XV. ANACARDIA'CEÆ. (CASHEW FAMILY.)

Trees or shrubs with milky, acrid juice, alternate leaves, and small, regular pentamerous, often polygamous, flowers with 3 styles or stigmas. Stipules none.

Rhus. Calyx small, 5-parted; stamens 5 under the edge or between the lobes of a flattened disk. Leaves compound.

1. **R. typhī'na,** L. (STAGHORN SUMACH.) Branches and stalks densely-velvety hairy; leaflets 11-31, pale beneath, oblong-lanceolate, pointed, serrate; tree 10-30 feet high.

2. **R. glabra,** L. (SMOOTH S.) Smooth, somewhat glaucous. Shrub 2-12 feet high.

ORDER XVI. LEGUMINO'SÆ. (PULSE FAMILY.)

Plants with papilionaceous, sometimes regular flowers; monadelphous, diadelphous or rarely-distinct stamens and a single, simple, free pistil, becoming a legume. Leaves alternate, with stipules. *Note.*—All plants found in this province have their stamens diadelphous.

Trifolium. Calyx 5-cleft, teeth bristle-form. Leaves of 3 leaflets. Flowers in heads.

1. **T. arven'se,** L. (Rabbit-foot or Stone Clover.) Stems 5-10 inches high; leaflets oblanceolate. Flowers white, silky and soft. Calyx-teeth fringed with silky hairs.

2. **T. praten'se,** L. (Red C.) Stems hairy; leaflets with a pale spot on the upper side, and often notched. Flowers purplish in sessile heads.

3. **T. me'dium,** L. (Zigzag C.) Stems zigzag, smoothish; leaflets oblong, entire, spotless; heads mostly stalked; flowers deeper purple than pratense.

4. **T. repens,** L. (White C.) Stems creeping; leaflets obcordate or notched; heads small and loose; flowers white; calyx much shorter than the corolla.

5. **T. hy'bridum,** L. (Alsike C.) Like T. repens, but the stems erect or ascending, not rooting at the nodes. Flowers rose-tinted.

6. **T. agra'rium,** L. (Yellow or Hop C.) Flowers yellow, reflexed when old; the 3 leaflets from the same point; stipules narrow; 6-12 inches high.

7. **T. procum'bens,** L. (Low Hop C.) Flowers yellow; leaflets wedge-obovate, the lateral ones a short distance from the terminal leaflet; 3-6 in. high.

Flowers racemed; leaflets truncate and toothed, of 3-leaflets; pods wrinkled.

8. **Melilo'tus alba,** Lam. (White Melilot.) Corolla white; the standard longer than the other petals.

Flowers racemed or spiked; pods curved.

9. **Medica'go lupuli'na,** L. (Black Medick.) Procumbent, pubescent, leaflets wedge-obovate, toothed at the apex; yellow flowers in short spikes; pods kidney-form.

Leaves pinnate, of many leaflets.

10. **Robin'ia pseudaca'cia,** L. (Common Locust.) Trees. Leaves odd-pinnate with spines for stipules. Racemes slender, loose. White flowers fragrant.

11. **R. visco'sa,** Vent. (CLAMMY LOCUST TREE.) Racemes crowded; flowers white with a reddish tinge. Leaf-stalks clammy. Very rare.

Herbs, with leaves abruptly pinnate, terminated with a tendril or bristle.

12. **V'icia sati'va,** L. (COMMON VETCH.) Leaflets 10-14, varying from obovate to linear. Flowers purple, one or two together, sessile in the axils.

13. **V. Cr'acca,** L. (TUFTED VETCH.) Leaflets 20-24, lanceolate and mucronate. Peduncles long, bearing a 1-sided raceme of blue flowers, bent downwards and turning purple.

14. **V. hirsu'ta,** Koch. Leaflets 12-16, linear; peduncles 3-6 flowered; corolla bluish, pods hairy.

Style flattened upwards, bearded down the inner face.

15. **Lath'yrus maritimus,** Bigelow. (BEACH PEA.) Stem stout, 1-ft. high; leaflets 8-16, ovate-oblong, stipules broadly-ovate and halberd-shaped, nearly as large as the leaflets. Peduncles 6-10 flowered, flowers purple.

16. **L. palus'tris,** L. (MARSH EVERLASTING PEA.) Stem wing-margined; leaflets 4-8, lanceolate or linear and mucronate. Stipules small, half arrow-shaped. Corolla blue-purple; peduncles 3-5 flowered.

17. **L. praten'sis,** L. (FIELD VETCHLING.) Leaflets a single pair, lanceolate, stipules large. Peduncles several flowered, flowers yellow. Rare.

ORDER XVII. **ROSA'CEÆ.** (ROSE FAMILY.)

Herbs, shrubs or trees with alternate, stipulate leaves and regular flowers. The petals mostly 5 and the stamens mostly more than 10, on a disk which lines the calyx-tube.

1. *Ovary superior and not enclosed in the calyx-tube at maturity.*

Prunus. Flowers perfect, lobes of calyx and corolla 5. Calyx deciduous after flowering. Fruit a drupe.

1. **P. Pennsylva'nica,** L. f. (WILD RED CHERRY.) Tree 20-30 feet high. Leaves oblong-lanceolate, pointed, sharply

serrate. Flowers clustered on long pedicles. Fruit light-red, sour.

2. **P. Virginia'na,** L. (CHOKE CHERRY.) Shrub 3–10 feet high with grayish bark; leaves oval, oblong or obovate, abruptly pointed; sharply, often doubly, serrate, with slender teeth. Flowers in racemes, short. Fruit turning to dark crimson. Astringent.

3. **P. sero'tina,** Ehrh. (WILD BLACK CHERRY.) Large, with reddish-brown branches, leaves oblong or lanceolate-oblong, taper-pointed, serrate with incurved short teeth. Flowers in long racemes, petals obovate; fruit purplish-black.

Spiræ'a. Flowers perfect or dioecious; pods follicles; leaves simple or pinnate, calyx 5-cleft; petals 5, obovate. Shrubs or perennial herbs.

4. **S. salicifo'lia,** L. (COMMON MEADOW SWEET.) Shrub 2–3 ft. high, nearly smooth. Leaves wedge lanceolate, doubly-serrate. Flowers in a crowded panicle, white or flesh color. —Wet grounds.

Rubus. Pistils numerous, fleshy in fruit; crowded on a spongy receptacle. Calyx 5-parted without bractlets. Petals 5, deciduous. Stamens numerous.

5. **R. triflo'rus,** Richardson. (DWARF RASPBERRY.) Stems ascending or trailing, 1-ft. high, not prickly. Leaflets 3–5, smooth, rhombic-ovate, acute at both ends, doubly serrate. Peduncles 1–3 flowered. Petals white; sepals reflexed. Fruit red.

6. **R. strigo'sus,** Michx. (WILD RED RASPBERRY.) Stems erect, beset with stiff, straight bristles. Leaflets 3–5, oblong-ovate, serrate, whitish beneath, cut-serrate. Petals as long as the sepals. Fruit light-red.

7. **R. villo'sus,** Ait. (HIGH BLACKBERRY.) Shrub 4–6 feet high, furrowed, upright or reclining, armed with stout curved prickles. Leaflets 3–5, unequally serrate, the terminal one with a long stalk. Flowers in racemes, white. Fruit oblong, black.

8. **R. Canaden'sis,** L. (LOW BLACKBERRY, DEWBERRY.) Stem shrubby, trailing, slightly prickly. Leaflets chiefly 3

(or pedately 5–7), oval or ovate-lanceolate, nearly smooth, serrate. Flowers in racemes, with leaf-like bracts.

9. **R. hispidus,** L. (RUNNING SWAMP BLACKBERRY.) Stems slender, scarcely woody, procumbent, beset with small, reflexed prickles. Leaflets 3 or 5, thickish, obovate, obtuse, coarsely serrate. Flowers small. Fruit of few grains, black.

Geum. Calyx-lobes usually with 5 alternating bractlets. Stamens and carpels numerous; styles becoming plumose or hairy, or naked and straight or jointed tails. Calyx 5-cleft; petals 5. Leaves pinnate or lyrate.

10. **G. macrophyl'lum,** Willd. (LARGE-LEAVED AVENS.) Stem bristly-hairy; root-leaves interruptedly pinnate, the terminal leaflet large; stem-leaves with small lateral leaflets and a large terminal one, all unequally toothed. Flowers large; petals yellow. Carpels becoming achenes.

11. **G. strictum,** Ait. Somewhat hairy, stem 2–3 ft. high, root-leaves interruptedly pinnate; stem leaves with 3–5 leaflets, obovate or ovate. Petals yellow, longer than the calyx.

Fraga'ria. Styles lateral, petals 5, conspicuous; receptacle becoming fleshy and pulpy, scarlet in fruit.

12. **F. Virginia'na,** Mill. (STRAWBERRY.) Achenes deeply imbedded in the surface of the fleshy receptacle. Calyx erect after flowering. Leaves radical, of 3 leaflets.

13. **F. ves'ca,** L. Achenes not embedded in the fleshy conical receptacle, calyx remaining spreading or reflexed.

Potentil'la. Petals 5, conspicuous; calyx lobes as many with an alternating set of bractlets. Stamens and achenes numerous on a dry receptacle.

14. **P. Norve'gica,** L. (NORWAY CINQUE-FOIL.) Stout, erect, hirsute, ½–2 feet high; leaves ternate, leaflets obovate or oblong-lanceolate, serrate. Calyx large, petals pale yellow, not longer than the sepals. Stamens about 15.

15. **P. argen'tea,** L. (SILVERY CINQUE-FOIL.) Stem white-woolly; leaves palmate of 5 leaflets with revolute margins, green above, white with silvery wool beneath. Petals yellow, longer than the sepals.

16. **P. frutico'sa,** L. (SHRUBBY C.) Shrubby, 1–4 ft. high, much branched. Leaves pinnate of 5–7 leaflets, oblong-lanceolate, entire, whiter beneath, margins revolute. Flowers large, yellow.

17. **P. tridenta'ta,** Ait. (THREE-TOOTHED C.) Stem 4–6 in. high; leaves palmate of 3 wedge-shaped leaflets, 3 toothed at the apex: petals white.

18. **P. anseri'na,** L. (SILVER-WEED.) Spreading by slender many-jointed runners. Leaves radical, interruptedly pinnate, leaflets 9–19, serrate, green above, silvery beneath. A seaside plant.

II. *Ovaries inferior or enclosed in the calyx-tube.*

Agrimo'nia. Calyx turbinate, with a margin of hooked prickles. Flowers yellow, in long racemes.

19. **A. Eupato'ria,** L. (COMMON AGRIMONY.) Leaflets 5–7 with minute ones intermixed, oblong-obovate, coarsely toothed, petals twice the length of the calyx.

Rosa. Prickly shrubs with odd-pinnate leaves. Petals 5, obovate or obcordate, inserted with the many stamens into the edge of the hollow disk that lines the calyx-tube.

20. **R. blanda,** Ait. (EARLY WILD ROSE.) Stem 1–3 feet high, nearly unarmed or with straight deciduous prickles. Leaflets 5–7, oval or oblong, serrate, cuneate at the base. Sepals entire; pedunceles 1–3 flowered. Styles separate.

21. **R. Caroli'na,** L. (SWAMP ROSE.) Stem 1–7 ft. high, armed with stout straight or curved spines; stipules long and narrow. Leaflets dull green, 5–9 oblong or elliptical, finely serrate; pedunceles and calyx glandular bristly. Numerous flowers in corymbs.

22. **R. lucida,** Ehrh. (DWARF WILD ROSE.) Stem 1–6 ft. high, armed with stout prickles. Leaflets 5–9 coarsely toothed, dark green, smooth and often shining above. Flowers corymbose or solitary, outer sepals often with 1 or 2 small lobes.

23. **R. rubigino'sa,** L. (SWEETBRIER. EGLANTINE.) Resembling the last, but the leaflets are densely resinous beneath, aromatic and doubly serrate. Pedicels and sepals hispid.

Cells of the ovary as many as the 2–5 styles.

Pyrus. Petals roundish or obovate, stamens numerous; pomes fleshy or berry-like, cells of a papery or cartilaginous texture; flowers in corymbed cymes.

24. **P. arbutifo'lia,** L. f. (CHOKE-BERRY.) Shrub 1–3 feet high; leaves simple, oblong or oblanceolate, finely serrate. Flowers white in cymes. Fruit dark-red or black.

25. **P. America'na,** D.C. (AMERICAN MOUNTAIN ASH.) Tree with pinnate leaves of 13–15 leaflets, leaflets lanceolate, taper-pointed, serrate, bright green. Fruit scarlet; flowers in cymes.

Crataegus. Pome drupe-like, containing 1–5 bony 1-seeded stones. Petals obovate. Thorny shrubs or small trees.

26. **C. oxyacan'tha,** L. (ENGLISH HAWTHORN.) Smooth, leaves obovate, cut-lobed and toothed, wedge-form at the base. Fruit small, ovoid, deep red; flowers large; styles 1–3.

27. **C. coccin'ea,** L. (SCARLET-FRUITED THORN.) Branches reddish; spines stout, chestnut-brown; leaves on slender petioles, thin, pubescent or glabrous, round-ovate, cuneate at base, acutely glandular-toothed, sometimes cut-lobed. Fruit bright red, ovoid, scarcely edible. Flowers ½ inch broad.

Amelanchier. Petals oblong, elongated. Stamens numerous, short. Styles 5, united below. The berry-like pome 10-celled with one seed in each. Small trees or shrubs.

28. **A. Canaden'sis,** Tor. and Gr. (JUNE-BERRY.) Tree 10–30 ft. high, nearly glabrous. Leaves ovate to ovate-oblong, usually cordate at the base; pointed, serrate. Flowers large, in drooping racemes; pedicels long. Var. **oblongifolia,** Tor. and Gr. Leaves broader and rounded at the base. Flowers in shorter racemes; pedicels shorter. Shrub 6–10 ft. high.

29. **A. alnifo'lia,** Nutt. Shrub 3–8 ft. high. Leaves glaucous and thickish, broadly elliptical or roundish, obtuse, rarely acute, coarsely toothed towards summit. Raceme short and rather dense. Fruit purple.

ORDER XVIII. **SAXIFRAGACEÆ.** (SAXIFRAGE FAMILY.)

Herbs or shrubs, having opposite and alternate leaves and no stipules. Stamens as many or twice as many as the petals, usually 5. Stamens and petals inserted on the calyx.

Herbs with opposite or radical leaves.

Mitella. Calyx short, 5 cleft, coherent with base of the ovary; petals 5, slender, pinnatifid; styles 2, very short.

1. **M. nuda,** L. (NAKED-STALKED MITRE-WORT.) Stem leafless, small and delicate. Leaves kidney-shaped; doubly-crenate. Flowers greenish, few, racemed; 4–6 in. high. Stamens 10.

Chrysosplenium. Calyx-tube coherent with ovary. Petals none. Stamens 10, inserted on a disk. Styles 2.

2. **C. America'num,** Schwein. (GOLDEN SAXIFRAGE.) Stem slender, decumbent and forking, leaves mostly opposite, roundish, somewhat heart-shaped; obscurely crenate-lobed; flowers distant, nearly sessile, greenish, tinged with yellow or purple.

Parnassia. Sepals, petals and proper stamens 5. Peduncle scape-like, 1-flowered. Petals white with greenish or yellowish veins.

3. **P. palustris,** L. (GRASS OF PARNASSUS.) Petals sessile, longer than the calyx, flower nearly 1 in. broad, 9–15 sterile filaments at the base of each petal. Scaped 3–10 in. high.

Shrubs, leaves alternate and simple.

Ribes. Calyx, 5-lobed, often colored, tube coherent with the ovary. Petals 5, small, stamens 5, alternate with the petals. Berry crowned with the remains of the calyx.

4. **R. oxyacanthoi'des,** L. (SMOOTH FRUITED GOOSEBERRY.) Peduncles very short, flowers greenish or dull purplish, 1–2 flowered. Stamens shorter than calyx. Stems with short thorns or none.

5. **R. flo'ridum,** L'Her. (WILD BLACK CURRANT.) Leaves with resinous dots, slightly heart-shaped, lobes 3–5, doubly serrate; racemes drooping; bracts longer than the pedicels; flowers large, whitish; fruit round-ovoid, black, smooth. Stems not thorny.

6. **R. ru'brum,** L. Var. subglandulo'sum, Maxim. (RED CURRANT.) Stems straggling or reclined; leaves somewhat heart shaped, obtusely 3-5 lobed, serrate, racemes from lateral buds, drooping. Fruit smooth, red.

ORDER XIX. CRASSULA'CEÆ. (ORPINE FAMILY.)

Succulent herbs with symmetrical flowers; the sepals, petals and carpels the same in number; the stamens as many or twice as many.

Tillæ'a. Sepals, petals, stamens and pistils 3 or 4. Leaves opposite, entire; flowers axillary.

1. **T. simplex,** Nutt. Rooting at the base, 1-2 in. high; leaves linear-oblong; flowers solitary, nearly sessile. Calyx half the length of the greenish white petals.

Sedum. Sepals and petals 4-5; stamens 8-10; follicles, many-seeded. Smooth and thick-leaved herbs.

2. **S. Tele'phium,** L. (GARDEN ORPINE. LIVE-FOR-EVER). Erect, 2 ft. high; leaves oval, obtuse, toothed, cymes compound; petals purple; follicles abruptly pointed with a short style.

ORDER XX. DROSERA'CEÆ. (SUNDEW FAMILY.)

Bog-herbs, low, glandular and hairy, with tufted radical leaves. Petals and stamens 5 each. Leaves circinate in the bud. Insectivorous plants.

Dro'sera. Styles 3, sometimes 5, deeply 2-parted so that they are taken for 6 or 10; capsule 3 or 5-valved.

D. rotundifo'lia, L. (ROUND-LEAVED SUNDEW.) Leaves orbicular, covered with reddish glandular hairs. Flowers white, small, in a 1-sided raceme.—Bogs.

ORDER XXI. HALORA'GEÆ. (WATER MILFOIL FAMILY.)

Aquatic or marsh plants with perfect or unisexual symmetrical flowers sessile in the axils of leaves or bracts. Ovary of 2-4 more or less united carpels. Petals small or none; stamens 1-8.

Myriophyl'lum. Flowers monœcious or polygamous, the parts in fours, with or without petals. Stamens 4 or 8. Leaves often whorled, the immersed pinnately dissected.

1. **M. spica'tum,** L. (WATER MILFOIL.) Stamens 8, bracts ovate, entire, shorter than the flowers. Leaves in whorls of 3 or 4. Flowers greenish in terminal spikes.

Hippu'ris. Flowers perfect or polygamous, calyx entire; petals none; stamen 1.

2. **H. vulga'ris,** L. (MARE'S TAIL.) Stems simple, 1–2 ft. high; leaves in whorls of 8 or 12, linear. Ponds and springs.

Callitriche. Flowers monœcious. Calyx and petals none. Stamen 1. Ovary 4-celled, with one pistil. Leaves entire, opposite.

3. **C. verna,** L. (WATER STARWORT.) Floating leaves obovate and 3 nerved, narrowed into a petiole. Submersed linear. Leaves beset with stellate scales.

ORDER XXII. **ONAGRA'CEÆ.** (EVENING PRIMROSE FAMILY.) Herbs with perfect and symmetrical flowers; calyx-tube adherent to the ovary; petals and stamens inserted on the calyx. Leaves opposite or alternate.

Epilo'bium. Seeds silky tufted; flowers small, not yellow; lower leaves often opposite. Petals 4, stamens 8.

1. **E. angustifo'lium,** L. (GREAT WILLOW HERB.) Stem simple, tall, 4–7 feet; leaves scattered, ample, lanceolate, nearly entire. Flowers large, purple, in a long raceme.

2. **E. colora'tum,** Muhl. Stem 1–2 ft. high, nearly smooth, with 2–4 hairy lines decurrent from the leaves. Leaves lanceolate or ovate-lanceolate, serrate, petioled. Flowers small; petals pale, deeply notched. Seeds with brownish coma.

3. **E. palus'tre,** L. Slender, 1 foot high, often branched, finely pubescent; leaves erect, about equalling the internodes, sessile, linear to linear-lanceolate, obtuse with revolute margins. Capsules mostly shorter than the slender peduncles.

Œnothe'ra. Calyx tube prolonged beyond the ovary, deciduous; the lobes 4, reflexed; petals 4, stamens 8, anthers linear and versatile. Seeds naked. Leaves alternate. Flowers yellow.

4. **Œ. bien'nis,** L. (COMMON EVENING PRIMROSE.) Rather stout, 2–4 ft. high, hairy. Leaves ovate-lanceolate. Flowers in a leafy spike. Pods oblong, narrowing towards the top.

5. **Œ. pu'mila,** L. (SMALL EVENING PRIMROSE.) Stem 5-12 in. high, smooth. Leaves lanceolate or oblanceolate. Pods nearly sessile, club-shaped, 4-angled.

Circe'a. Petals 2, obcordate or 2-lobed. Stamens 2; fruit 1-2 seeded, bristly.

6. **C. alpi'na,** L. (ENCHANTER'S NIGHTSHADE.) Stem 3-5 in. high, smooth and weak. Leaves opposite, cordate, thin, shining, coarsely toothed; bracts minute. White flowers in racemes.

ORDER XXIII. UMBELLI'FERÆ. (PARSLEY FAMILY.)

Herbs with small flowers, mostly in umbels. Calyx adhering to the 2-celled 2-ovuled ovary. The 5 petals and 5 stamens inserted on the disk that crowns the ovary and surrounds the base of the two styles. Fruit consisting of 2 seed-like dry carpels which cohere by their inner face and separate when ripe. Stems usually hollow; leaves alternate, mostly compound. The base of the styles is frequently thickened and cushion-like and is called the *stylopodium.*

* *Seeds flat on the inner face. Umbels regularly compound.*

Daucus. Calyx-teeth obsolete; fruit oblong, flattened dorsally; stylopodium depressed. White flowers.

1. **D. caro'ta,** L. (CARROT.) Biennial; stem bristly.—Wild occasionally in old fields.

Angel'ica. Calyx-teeth obsolete. Fruit flattened dorsally. Flowers white or greenish.

2. **A. atropurpu'rea,** L. (GREAT ANGELICA.) Stout, glabrous, with dark purple stem, 4-6 ft. high; leaves 2-3 ternately divided.—River banks.

Heracle'um. Calyx-teeth minute. Fruit broadly oval or obovate but with a thick conical stylopodium. White flowers.

3. **H. lanatum,** Michx. (COW-PARSNIP.) Woolly; stem grooved, 4-8 ft. high. Leaflets broad, irregularly cut-toothed. —Wet ground.

Pastina'ca. Calyx-teeth obsolete. Fruit oval, very much flattened dorsally. Stylopodium depressed.

4. **P. sati'va,** L. (PARSNIP.) Stem grooved. Leaflets ovate to oblong, cut-toothed. Flowers, yellow.

Ligu'sticum. Calyx-teeth obsolete. Fruit oblong or ovate, flattened laterally; if at ~~all~~ glabrous. Stylopodium conical. White flowers.

5. **L. Sco'ticum,** L. (SCOTCH LOVAGE.) Stem simple, 1-2 ft. high; leaves bi-ternate, leaflets ovate, 1-2 in. long, coarsely toothed. Fruit ~~narrowly~~ oblong. – Salt marshes.

Sium. Calyx-teeth ~~minute~~; fruit ovate to oblong, glabrous. Stylopodium depressed. Stem grooved. Flowers white.

6. **S. cicutæfo'lium,** Gmelin. (WATER PARSNIP.) Stout, 2-6 ft. high; leaflets 3-8 pairs, linear to lanceolate, sharply pointed and serrate, 2-5 in. long.

Carum. Calyx-teeth small; fruit ovate or oblong, glabrous with filiform ribs. Stylopodium conical. Stem smooth. Flowers white.

7. **C. Ca'rui,** L. (CARAWAY.) Leaves ~~pinnately~~ compound, with filiform divisions.

Cicu'ta. Calyx-teeth prominent, fruit oblong to nearly orbicular, glabrous, with strong flattish, corky ribs. Stylopodium depressed. Flowers white.

8. **C. macula'ta,** L. (SPOTTED COWBANE. ~~MUSQUASH ROOT.~~) Stem stout, 2-6 ft. high, streaked with purple. Leaves 2-3 pinnate, the lower on long petioles; leaflets ovate-lanceolate, acuminate, coarsely serrate.—Swamps.

9. **C. bulbi'fera,** L. (~~BULB-BEARING COWBANE.~~) Rather slender, 1-3 ft. high; leaves 2-3 pinnate, leaflets linear; upper axils bearing ~~chocolate~~ bulblets.—In swamps.

* * *Inner face of seeds hollowed lengthwise.*

Osmorrhi'za. Calyx-teeth obsolete, fruit linear to linear-oblong with prominent caudate attenuation at the base, very bristly, with equal ribs. Flowers white.

10. **O. brevi'stylis,** D.C. (HAIRY SWEET CECILY.) Rather stout, villous-pubescent. Leaves 2-3 ternate, leaflets 2-3 inches long, pointed. Stylopodium and style ½ line long.

ORDER XXIV. **ARALIA'CEÆ.** (GINSENG FAMILY.)

Herbs, shrubs or trees with much the same character as Umbelliferæ, but with usually more than 2 styles, and the fruit a few-several-celled drupe. The umbels single, corymbed or panicled.

Aral'ia. Calyx-tube coherent with the ovary; petals 5, epigynous, oblong or ovate, deciduous. Stamens 5, epigynous, alternate with the petals. Styles 2-5, distinct in fertile flowers. Flowers white or greenish.

1. **A. racemo'sa,** L. (SPIKENARD.) Umbels in a large compound panicle. Stem 2-3 ft. high. Leaves very large and decompound. Leaflets ovate, cordate, doubly serrate.

2. **A. hispida,** Vent. (BRISTLY SARSAPARILLA.) Stem 1-2 ft. high, bristly, leafy. Umbels 2-7, corymbed. Leaves 2-pinnate; leaflets oblong-ovate, acute, serrate.

3. **nudicau'lis,** L. (WILD SARSAPARILLA.) Stem scarcely rising out of the ground, sending up a naked scape, bearing 2-7 umbels, and a single long-stalked leaf in 3 divisions, 5 leaflets to each division.

ORDER XXV. **CORNA'CEÆ.** (DOGWOOD FAMILY.)

Shrubs or trees, rarely herbs, with opposite or alternate simple leaves, the calyx-tube coherent with the 1-2-celled ovary, its limb minute, the petals and stamens on the ovary. Style 1.

Cornus. Flowers perfect. Calyx minutely 4-toothed. Petals 4, oblong, spreading. Stamens 4, filaments slender. Leaves opposite except in one species, entire.

Flowers greenish, in a head or cluster.

1. **C. Canad'ensis,** L. (BUNCH-BERRY. DWARF CORNEL.) Flowers surrounded by a large 4-leaved white involucre. Stem 5-7 in. high. Lower leaves scale-like; the upper in a whorl of 6 or 4, ovate or oval, pointed. Fruit bright red. Flowers white in open flat-spreading cymes.

2. **C. stoloni'fera,** Michx. (RED OSIER DOGWOOD.) Shrub 3-6 ft. high; branches red-purple, smooth. Leaves opposite, ovate, whitish beneath. Fruit whitish. Wet places.

3. **C. alternifo'lia,** L. f. (ALTERNATE-LEAVED C.) Shrub or tree, 8–25 ft. high; branches greenish, streaked with white; the alternate leaves clustered at the ends, ovate or oval, acute at both ends. Flowers yellowish; fruit blue on reddish stalks.

II. GAMOPETALOUS DIVISION.

Plants with both calyx and corolla, the latter with the petals more or less united.

ORDER XXVI. CAPRIFOLIA'CEÆ. (HONEYSUCKLE FAMILY.)

Shrubs, rarely herbs, with the calyx-tube adherent to the ovary; the corolla on the ovary and the stamens, on the tube of the corolla. Leaves opposite. Fruit a berry, drupe or pod.

Sambu'cus. Stamens as many as lobes of the corolla; flowers in compound cymes.

1. **S. racemo'sa,** L. (RED-BERRIED ELDER.) Stems woody, 2–10 ft. high, the bark warty; pinnate leaves of 5–7 leaflets, ovate-lanceolate, serrate. Fruit bright red.

Viburnum. Fruit a 1-celled, 1-seeded drupe with a compressed stone; leaves simple, flowers white in compound, flat cymes.

2. **V. cassino'ides,** L. (WITHE-ROD.) Leaves thickish and opaque or dull, ovate to oblong, obtuse, 1–3 in. long, denticulate, entire or wavy-toothed margins. Peduncle shorter than the cyme.

Linn[illegible]. Stamens 4, 1 fewer than the lobes of the corolla. Fruit 3-celled, but only 1-seeded. Creeping, with long-peduncled twin flowers.

3. **L. borealis,** L. (TWIN FLOWER.) A creeping plant, with evergreen, oval, crenate leaves, forking peduncles and purplish flowers.

Lonice'ra. Corolla tubular and more or less irregular. Stamens 5. Leaves entire, flowers often showy.

4. **L. cilia'ta,** Muhl. (FLY HONEYSUCKLE.) Branches straggling, 3–5 ft. high. Leaves oblong-ovate, often cordate, petioled, thin. Filiform peduncles shorter than the leaves.

Corolla funnel-form, almost spurred, greenish yellow. Berries separate, red.

Diervilla. Stamens 5, corolla funnel-form, nearly regular. Pod ovoid oblong, 2-valved, many-seeded.

5. **D. tri'fida**, Moench. (Bush Honeysuckle.) Leaves oblong-ovate, taper-pointed, serrate, petioled. Pedunicles mostly 3-flowered, pod long-beaked. Flowers honey-color.

Order XXVII. **RUBIA'CEÆ.** (Madder Family.)

Shrubs or herbs with opposite, entire leaves with interposed stipules or in whorls without stipules. Calyx coherent with the 2-4 celled ovary, stamens as many as the lobes of the regular corolla 4-5 and inserted on its tube.

Ga'lium. Corolla wheel-shaped, 4 or rarely 3 parted. Fruit twin, separating into 2 indehiscent carpels. Leaves in whorls, no stipules. Stems square; styles 2.

1. **G. tri'fidum,** L. (Small Bedstraw.) Stems weak, ascending 5-20 in. high, mostly roughened backward on the angles; leaves in whorls of 4-6, linear or oblanceolate; margins and midribs rough. Pedunicles 1-7 flowered.

2. **G. aspr'ellum,** Michx. (Rough Bedstraw.) Stem branched, rough backwards with hooked prickles, leaning on bushes, 3-5 ft. high; leaves in whorls of 6, or 4-5 on the branchlets; oval-lanceolate with almost prickly margins. Pedunicles 2-3 times forked, short.

3. **G. triflo'rum,** Michx. (Sweet-scented B.) Stem 1-3 ft. long, roughened backwards on the angles; leaves elliptical-lanceolate, bristle-pointed 1-2 in. long. Pedunicles 3-flowered, greenish; fruit with hooked bristles.

Order XXVIII. **COMPO'SITÆ.** (Composite Family.)

Flowers in a close head, on a common receptacle, surrounded by an involucre, with 5 stamens inserted on each corolla, the anthers united into a tube (syngenesious.) Calyx-tube united with the 1-celled ovary, the limb called the pappus, crowning its summit in the form of bristles, awns, scales, teeth or cup-

shaped, or else entirely absent. Corolla strap-shaped or tubular. Styles 2 cleft at the apex.

The flowers with a strap-shape (*ligulate*) corolla are called *rays* or *ray-flowers*; the head with such flowers either throughout or at the margin is *radiate*. The tubular flowers compose the disk; and a head which has no ray-flowers is said to be discoid.

The leaves of the involucre are termed scales. The bracts which often grow on the receptacle amongst the flowers are called the *chaff*; when they are wanting, the receptacle is said to be naked.

TUBULIFLORÆ. Corolla tubular in all the perfect flowers, regularly 5-lobed, ligulate only in the marginal or ray flowers which are pistillate only, or neutral.

Eupato'rium. Involucre of more than 4 scales, flowers few or many. Heads discoid, the flowers all perfect and tubular. Achenes 5-angled. The pappus a single row of slender capillary bristles.

1. **E. purpureum,** L. (JOE-PYE WEED. TRUMPET W.) Stems stout and tall, 2–10 ft. Leaves 3–6 in a whorl, oblong-ovate or lanceolate, pointed, roughish, toothed; corymbs dense and compound. Flowers purplish.

2. **E. perfolia'tum,** L. (THOROUGHWORT. BONESET.) Stem stout, 2–4 ft., hairy; leaves lanceolate connate-perfoliate, pointed, serrate, wrinkled, downy beneath, 5–8 in. long. Heads 10–15-flowered. White.

Solida'go. Golden Rod. Heads few to many flowered, radiate, the rays 1–16, pistillate; scales of the oblong involucre appressed. Receptacle, small, not chaffy. Achenes many-ribbed, nearly terete. Heads racemed or clustered, flowers of disk and ray yellow, excepting the first.

3. **S. bicolor,** L. (WHITE-RAYED GOLDEN-ROD.) Hoary with soft hairs; leaves oblong or elliptical lanceolate, acute at both ends, slightly serrate. Short racemes from the axils of the upper leaves. Rays whitish. Var. **concolor,** Torr. and Gr., has yellow rays and is much commoner than bicolor. Both species and variety grow together along the coast north of St. Peter's.

** Heads in 1-sided racemes, spreading or recurved.*

4. **S. sempervi'rens,** L. Smooth and stout, 1-8 ft. high. Leaves lanceolate, slightly clasping or lower, lanceolate-oblong, obscurely 3-nerved. Racemes short; heads showy; golden rays, 7-10.—Salt marshes or near the coast.

5. **S. pube'rula,** Nutt. Stem (1-3 ft. high, simple or branched) and panicle minutely hoary, stem-leaves lanceolate, acute, tapering to the base, smoothish; the lower wedge-lanceolate and sparingly toothed; heads numerous and crowded in compact short racemes forming a dense, narrow or pyramidal panicle. Scales linear, awl-shaped, appressed. Rays about 10.

6. **S. uliginо'sa,** Nutt. Smooth nearly throughout; stem simple, strict 2-3 ft. high; leaves lanceolate, pointed, the lower tapering into winged petioles, partly sheathing at the base, sparsely serrulate or entire; racemes much crowded and appressed in a wand-like panicle; scales linear-oblong; rays 5-6, small; root-leaves 6-10 in. long.—Peat bogs. Flowers early.

7. **S. rugo'sa,** Mill. Rough-hairy, especially the leafy stem, 1-6 ft. high; leaves ovate-lanceolate, elliptical or oblong, often thickish and very rugose; racemes spreading; scales linear; rays 6-9; the disk flowers 4-7.—Borders of fields and copses; common.

*** Racemes 1-sided and recurved, leaves 3-ribbed.*

8. **S. sero'tina,** Ait. (**S. gigantea,** Torr. and Gr.) Stem stout, 2-7 ft. high, smooth, often glaucous; leaves quite smooth both sides, lanceolate, taper-pointed, very sharply serrate, except the narrowed base, rough-ciliate. Rays 7-14, long.—Copses and fence-rows.

9. **S. Canaden'sis,** L. Stem rough, hairy, tall and stout, 3-6 ft. high; leaves lanceolate, pointed, more or less sharply serrate and pubescent beneath, rough above; heads small; rays very short.—Borders of thickets and fields. Common.

**** Inflorescence a flat-topped corymb.*

10. **S. lanceola'ta,** L. Leaves lanceolate-linear, 3-5-nerved; nerves, margins and angles of the branches minutely rough-

pubescent, heads in dense corymbed clusters. Rays 15-20; stem 2-3 ft. high; leaves 3-5 in. long. Common.

Aster. Starwort. Heads many flowered, radiate the ray-flowers in a single series, pistillate. Scales of the involucre imbricated, usually with herbaceous tips, receptacle flat. Achenes more or less flattened; pappus of capillary bristles, mostly in a single row. Flowers in corymbs, panicles or racemes. Rays white, purple or blue; disk yellow.

Lower leaves heart-shaped and petioled.

11. **A. macrophyl'lus,** L. Stem stout and rigid, 2-3 ft. high; leaves thickish, rough, serrate; the lower, heart shaped, 4-10 in. long, long-petioled; the upper ovate or oblong, sessile or on marginal petioles. Heads in close corymbs, rays 10-15, white or bluish.

12. **A. cordifo'lius,** L. Stem much branched above. Rays pale blue or nearly white; scales tipped with short green points. Heads small; leaves thin, serrate, lower ones heart-shaped, on slender ciliate petioles.

* * *Upper leaves sessile or clasping by a cordate-base; lower ones not cordate.*

13. **A. læ'vis,** L. Stout 2-4 ft. high; rays sky-blue, large; heads in a close panicle. Leaves lanceolate or ovate-lanceolate, chiefly entire; upper clasping by an auricled base. Achenes smooth.

* * * *None of the leaves cordate, those of the stem sessile, base tapering*

14. **A. multiflo'rus,** Ait. Rays white, or rarely bluish, 10-20; stem hoary with minute pubescence, 1 ft. high; bushy. Leaves linear, rigid, small, with rough margins; upper partly clasping. Heads small, crowded, racemed.

15. **A. diffu'sus,** Ait. More or less pubescent; leaves lanceolate or oblong-lanceolate, tapering at each end, sharply serrate in the middle; scales of the involucre linear, imbricated in 3 or 4 rows. Leaves 2-5 in. long. Rays mostly short, white or pale bluish-purple.

16. **A. salicifo'lius,** Ait. Rays large, bluish, purplish or almost white. Stem smooth or the branches rough and pubescent. Leaves somewhat pointed, firm, lanceolate, often

scabrous. Scales of the involucre closely imbricated, abruptly acute, lanceolate.

17. **A. puni'ceus,** L. Rays long, lilac-blue. Stem 3-6 ft. high, stout, rough-hairy all over or in lines, purple below. Leaves oblong-lanceolate, aurieled, serrate in the middle, rough above, smooth beneath, pointed.

18. **A. umbella'tus,** Mill. Smooth, leafy to the top, 2-7 ft. high; leaves lanceolate, elongated, taper-pointed and tapering at the base, 3-6 in. long. Heads numerous in compound flat corymbs; scales scarcely longer than the achenes. Pappus double.

19. **A. acumina'tus,** Michx. Somewhat hairy stem, 1 ft. high, simple, zig-zag, panicled. Peduncles slender. Leaves oblong-lanceolate, pointed, coarsely toothed towards the apex; wedge-form and entire at the base; involueral scales few. Rays 12-18, white or faintly purple.

Eri'geron. Heads many-flowered, radiate; the narrow rays numerous, pistillate. Involucral scales, narrow and equal, never coriaceous or green-tipped. Achenes flattened, usually 2-nerved. Pappus a row of capillary bristles with minuter ones intermixed. Disk yellow, rays white or purple.

20. **E. Canaden'sis,** L. (Horse-weed. Butter-weed.) Bristly-hairy; stem erect, wand-like, 1-5 ft. high; leaves linear, mostly entire, the radical cut-lobed. Heads numerous and small, cylindrical, panicled. Rays white, ligule shorter than the tube.

21. **E. strigo'sus,** Muhl. (Daisy Fleabane.) Stem panicled, corymbose at the summit, roughish like the leaves, with minute appressed hairs, or almost smooth; leaves entire or nearly so, the upper lanceolate; the lowest oblong or spatulate, tapering into a slender petiole; rays white, twice the length of the minutely hairy involucre.—Fields, common.

Antenna'ria. Heads many flowered, dioecious, flowers all tubular, pistillate corollas, very slender. Involucre dry and scarious, white or colored, imbricated. Receptacle convex or flat, not chaffy. Anthers caudate, achenes terete or flattish; pappus a single row of bristles, in the fertile flowers capillary, united at

the base, and in the sterile thickened and club-shaped and barbed at the summit. White, woolly.

22. **A. plantaginifo'lia,** Hook. (PLANTAIN-LEAVED EVERLASTING.) Spreading by offsets and runners, 3 18 in. high; leaves silky woolly when young, at length green above, hoary beneath, those of the simple flowering stems, small; lanceolate, appressed; the radical obovate or oval-spatulate, petioled, 3-nerved. Scales of the mostly white involucre obtuse in the sterile, and acutish and narrower in the fertile plant.

Ana'phalis. Like Antennaria, but the pappus in the sterile flowers not thickened at the summit or scarcely so, and that of the fertile not united at the base. Fertile heads usually with a few perfect flowers in the centre.

23. **A. margarita'cea,** Benth and Hook. (PEARLY EVERLASTING.) Stem 1 2 ft. high, corymbose at the summit, with many heads, leafy; leaves broadly to linear lanceolate, taper-pointed, sessile, soon green above; involucral scales, pearly white, very numerous, obtuse or rounded.

Gnaph'alium. Heads many-flowered; flowers all tubular, the outer pistillate and slender, central perfect. Scales of the involucre dry and scarious, white or colored, imbricated in several rows. Receptacle flat, naked. Anthers caudate. Achenes terete or flattish. Pappus a single row of capillary, rough bristles. Corolla whitish or yellowish.

24. **G. polyce'phalum,** Michx. (COMMON EVERLASTING.) Woolly annual, 1 3 ft. high, fragrant, leaves lanceolate, tapering at the base, with undulate margins, not decurrent, smoothish above; heads clustered at the summit of the branches, ovate-conical before expansion, then obovate; scales whitish, ovate and oblong, rather obtuse; perfect flowers few.—Old fields.

25. **G. uligin'osum,** L. (LOW CUDWEED.) Diffusely branched, appressed, woolly annual, 3 6 in. high; leaves spatulate-oblanceolate or linear, not decurrent, heads small in terminal sessile capitate clusters, subtended by leaves, scales brownish.—Low grounds; common.

26. **G. purpu'reum,** L. (PURPLISH CUDWEED.) Annual, simple or branched from the base, 6 20 in. high, leaves oblong-spatulate, obtuse, not decurrent, green above, covered with

white wool underneath; heads in sessile clusters in the axils of the upper leaves and spiked at the summit of the stem; scales tawny, inner often marked with purple.

Ambro'sia. Sterile and fertile flowers occupying different heads on the same plant. Fertile 1-3 together and sessile in the axils of leaves or bracts, at the base of the racemes or spikes of sterile heads. Sterile involucres flattish or top-shaped, of 7-12 scales united into a cup, containing 5-20 funnel-form staminate flowers. Fertile involucre oblong or top-shaped, closed, pointed, resembling an achene and enclosing a single flower which consists of a pistil only. Pappus none.

27. **A. artemisiæfolia,** L. (Roman Wormwood. Hog-weed. Bitter-weed.) Much branched, 1-3 ft. high, hairy or rough-pubescent, leaves thin, twice-pinnatifid, smooth above, paler beneath; fruit globular, armed with about 6 short acute teeth.

Rudbec'kia. Heads many-flowered, radiate, the rays neutral. Scales of the involucre leaf-like, in about 2 rows. Receptacle conical. Achenes 4-angular, smooth, not margined, flat at the top, with no pappus or a minute crown-like border.

28. **R. hir'ta,** L. (Cone-Flower.) Bristly-hairy, stems simple or branched near the base, stout, 1-2 ft. high, bearing single large heads; leaves nearly entire; the upper oblo lanceolate, sessile; the lower spatulate, triple-nerved, pet Rays about 14. Rays long, yellow; disk, brown.

Helian'thus. Rays yellow, neutral. Involucre imbricated. Recep tacle flat or convex. Chaff embracing the 1-sided achenes. Pappus of two thin scales, deciduous.

29. **H. an'nuus,** L. (Common Sunflower.) Tall, rough; leaves 3-ribbed, ovate or the lower cordate, serrate; scales ovate, long-pointed, ciliate.—Waste grounds. Escaped from gardens.

Bi'dens. Rays, when present, 3-8, neutral. Scales in 2 rows, the outer large and leaf-like. Achenes crowned with 2 or more awns which are barbed downwards. Flowers yellow.

30. **B. frondo'sa,** L. (Common Beggar-ticks.) Tall, 2-6 ft., branching; leaves 3-5 divided, leaflets stalked, lanceolate, pointed. Achenes wedge-obovate, 2-awned. No rays.

31. **B. connata,** Muhl. (SWAMP BEGGAR-TICKS.) Achenes flat, 2-4-awned, ciliate, bristles pointing downwards. Leaves lanceolate, serrate, connate at the base. No rays. In water and wet grounds.

32. **B. cernua,** L. (SMALLER BUR-MARIGOLD.) Rays short, pale yellow. Achenes flat, 4-awned, ciliate, bristles pointing downwards. Stem smooth, 5-10 in. high. Leaves simple, lanceolate, serrate, hardly connate.—Wet places.

Anthemis. Rays pistillate or neutral. Involucre of many imbricated, dry and scarious scales, shorter than the disk. Achenes terete or ribbed, pappus none or a minute crown. Rays white, disk yellow. Leaves finely and pinnately dissected.

33. **A. Cotula,** D.C. (MAYWEED.) Rays mostly neutral; receptacle without chaff near the margin; pappus none. Leaves 3-pinnately dissected. Strong scented.—Roadsides.

Achillea. Heads radiate, rays few, pistillate; scales imbricated with scarious margins; receptacle chaffy, flattish. Achenes oblong, flattened, margined, pappus none. Perennials, heads corymbose, small.

34. **A. Millefolium,** L. (COMMON YARROW or MILFOIL.) Stems simple; leaves 2-pinnately parted, divisions linear, 3-5 cleft, crowded. Corymb flat-topped; rays 4-5 short, white, sometimes rose color.—Fields; common.

35. **A. Ptarmica,** L. (SNEEZE-WORT.) Leaves simple, lance-linear, serrate. Rays 8-12, much longer than the campanulate involucre. Flowers white. Rare.

Matricaria. Rays white, pistillate or wanting; scales with scarious margins; receptacle conical. Achenes 3-5 ribbed, wingless; pappus, a crown, border or none.

36. **M. inodora,** L. (WILD CHAMOMILE.) Leaves 2-pinnately divided into almost filiform lobes, heads large, naked pedunculed with many long rays. Achenes 3-ribbed, pappus a short crown or border.

Chrysanthemum. Rays numerous, white, fertile; scales with scarious margins, disk-corollas with a flattened tube. Achenes of disk and ray similar, striate without pappus.

37. **C. Leucanthemum,** L. (OX-EYE or WHITE DAISY.) Stem naked above, bearing one large head. Root-leaves

spatulate, petioled, others partly clasping, all cut or pinnatifid-toothed. Scales with rusty brown margins. – Fields and meadows.

Tanace'tum. Flowers yellow, in numerous corymbed heads. Scales of the involucre dry, imbricated. Achenes angled, or ribbed with a large flat top. Rays none.

38. **T. vulgare,** L. (Common Tansy.) Stem 2–4 ft. high, smooth; leaflets and the wings of the petioles cut-toothed. Corymb dense; pistillate flowers terete, with oblique 3 toothed limb; pappus 5-lobed.

Petasi'tes. (Sweet Coltsfoot.) Rays whitish, heads in a corymb, scales of the involucre in a single row. Heads dioecious, staminate with one row of pistillate ray flowers; pistillate with ray-flowers in many rows. Leaves all from the rootstock; the scape with sheathing bracts.

39. **P. palmata,** Gray. Leaves rounded, somewhat kidney-form, deeply palmately 5–7-lobed, the lobes toothed and cut, woolly underneath. – May. Near Southport.

Senec'io. Rays pistillate or none, yellow when present. Scales of the involucre in a single row, or with a few bractlets at the base. Pappus fine and soft. Heads corymbose. Leaves alternate.

40. **S. vulga'ris,** L. (Common Groundsel.) Low, branched and glabrate. Leaves pinnatifid and toothed; clasping tips of involucral scales blackish; rays none.

41. **S. au'reus,** L. (Golden Ragwort. Squaw-weed.) Smooth, floccosely woolly when young, 1–3 ft. high. Leaves thin, the radical simple and rounded, the larger mostly cordate, crenate, long petioled; stem-leaves sessile, lanceolate, deeply pinnatifid. Var. **Balsa'mitæ,** Torr. and Gr. Less glabrate, root-leaves oblong, spatulate, narrowed to the petiole, serrate; upper lyrate-pinnatifid. Heads small and numerous.

42. **S. Jacobæ'a,** L. (Common or Tansy Ragwort.) Flowers golden yellow, the head forming a spreading corymb. Stem 2–3 ft. high, branching, glabrous or somewhat cottony. Leaves numerous, lyrate, bipinnatifid, the lower with broad segments, the upper with linear divisions.

Arctium. Flowers all tubular, perfect and similar; the imbricated scales of the involucre with stiff points and hooked tips. Achenes flattened and transversely wrinkled; pappus short.

43. **A. Lappa,** L. (BURDOCK.) Stout, 1-3 ft. high. Leaves large, ovate and mostly cordate, or lanceolate with cuneate base, smooth above, floccose beneath.

Cnicus. Flowers all tubular, perfect and similar, reddish-purple, rarely dioecious; scales imbricated in many rows, tipped with a point or prickle. Receptacle with soft bristles or hairs. Achenes flat, not ribbed. Pappus of numerous bristles basally united.

Scales of the involucre all tipped with prickles.

44. **C. lanceola'tus.** Hoff. (COMMON THISTLE.) Leaves decurrent on the stem, forming prickly lobed wings, pinnatifid, rough and bristly above, woolly beneath, prickly. Flowers purple.

Scales appressed, inner not prickly.

45. **C. altissimus,** Willd. Var. Discolor, Gray. (DOWNY THISTLE.) Stem downy, branching, 2-6 ft. high, grooved. Leaves prickly, green above, white-woolly beneath. Flowers pale purple.

Outer scales barely prickly-point; heads small and numerous.

46. **C. arvensis,** Hoffm. (CANADA THISTLE.) Stem 1-2 ft. high, roots creeping; leaves oblong or lanceolate, smooth or slightly woolly beneath; sinuate-pinnatifid, prickly-margined. Flowers rose-purple. - Cultivated fields.

Centaurea. Flowers all tubular, marginal larger and sterile; receptacle bristly; the imbricated scales margined. Achenes attached obliquely near the base. Leaves alternate. Heads single.

47. **C. nigra,** L. (KNAPWEED.) Scales of the involucre with a black ciliate fringe. Leaves lanceolate, mostly entire, rough. Flowers purple.

LIGULIFLORÆ. Corolla ligulate in all the flowers of the head, and all the flowers perfect. Herbs, with milky juice. Leaves, alternate.

Lampsana. Heads 8-12 flowered, yellow. Scales 8, in a single row. Achenes oblong; pappus none; flowers yellow.

48. **L. communis,** L. (NIPPLEWORT.) Slender, nearly smooth, 1-2 ft. high, lower leaves ovate, sometimes lyre-shaped. - Roadsides. Very rare.

Cichorium. Involucre double, the inner of 8-10 scales; the outer 5, spreading. Achenes striate; pappus of many small chaffy scales, forming a short crown. Flowers blue, axillary in our species.

49. **C. Intybus,** L. (CHICORY.) Stem leaves oblong or lanceolate, partly clasping, the lowest runcinate, those of the branches minute.

Leontodon. Involucre with bractlets at the base. Achenes spindle-shaped, striate; pappus of plumose bristles, flattened at the base. Stemless perennials with pinnatifid root-leaves, scapes bearing one or more yellow heads.

50. **L. autumnalis,** L. (FALL DANDELION.) Leaves somewhat pubescent; scape branched, 5-15 in. high. Peduncles thickened at the summit.

Hieracium. Heads 12 many-flowered. Involucre imbricated; achenes short, oblong, or columnar, striate. Pappus a single row of tawny, rough bristles. Hispid, often glandular plants.

51. **H. aurantiacum,** L. (ORANGE HAWKWEED.) Low, hirsute; leaves at the base. Heads clustered, deep orange.

52. **H. scabrum,** Michx. (ROUGH HAWKWEED.) Heads small; stem stout, 1-3 ft. high, leafy, rough-hairy; pedicels and the 40-50 flowered involucre beset with dark, glandular bristles. Leaves hairy, entire, oval or obovate. Flowers yellow.

Prenanthes. Flowers greenish, white or yellowish; heads 5-30 flowered; involucre of 5-11 linear scales in a single row with a few bractlets. Achenes short, striate or grooved; not contracted at the apex. Pappus of straw-color, or brownish rough bristles.

53. **P. alba,** L. (WHITE LETTUCE. RATTLESNAKE ROOT.) Smooth and glaucous, 2-4 ft. high. Leaves angulate or triangular-halberd-form or 3-5 cleft, the uppermost oblong and undivided. Involucre purplish, of about 8 scales, 8-12 flowered. Borders of woods.

Taraxacum. The many-flowered head, large and solitary on a slender hollow scape. Involucre double, the outer of short scales. Achenes oblong-ovate, extended into a slender beak.

54. **T. officinale,** Weber. (COMMON DANDELION.) Smooth or at first pubescent; outer scales reflexed.—Pastures and fields everywhere.

Lactu'ca. Flowers pale yellow or purplish. Florets about 20 in the head. Scales imbricated in two or more sets of unequal lengths. Achenes compressed parallel to the scales, contracted into a beak, which is dilated at the apex, bearing a soft and white pappus.

55. **L. Canaden'sis,** L. (Wild Lettuce.) Tall, 4–9 ft. high, very leafy, smooth, glaucous; leaves 6–12 in. long, pale beneath, mostly sinuate-pinnatifid, the upper lanceolate and entire. Heads about 20 flowered, flowers pale yellow. Achene oval, longer than the beak.

56. **L. integrifo'lia,** Bigel. Less leafy, 3–4 ft. high, loosely branched above; leaves undivided, oblong-lanceolate, pointed, entire or denticulate. Flowers yellow or purplish.

57. **L. hirsu'ta,** Muhl. Rather few-leaved, 2–3 ft. high, commonly hirsute at base. Leaves hirsute both sides or only on the midribs. Flowers yellow-purple.

58. **L. leucophæ'a,** Gray. Nearly smooth, 3–12 ft. high, leafy; leaves irregularly pinnatifid, sometimes runcinate, coarsely toothed; the upper sessile and auriculate. Flowers bluish to cream color. Achene short-beaked; pappus tawny.

Son'chus. Heads becoming umbrid at the base. Achenes flattened parallel to the scales, ribbed or striate, not beaked. Pappus of soft and fine white bristles. Coarse weeds with yellow flowers.

59. **S. olera'ceus,** L. (Common Sow-Thistle.) Stem-leaves runcinate-pinnatifid, toothed with soft spiny teeth; clasping; the auricles acute.

60. **S. arven'sis,** L. (Field Sow-Thistle.) The spiny-toothed, runcinate leaves clasping by a heart-shaped base. Peduncles and involucres bristly.

Order XXIX. LOBELIA'CEÆ. (Lobelia Family.)

Herbs with acrid, milky juice and alternate leaves. Corolla irregular, 5-lobed, the tube split down one side. Stamens 5, syngenesious and commonly monadelphous, free from the corolla. Style 1.

Lob'elia. Corolla with the tube split on one side, somewhat 2-lipped. Pod 2-celled, opening at the top. Flowers axillary or in bracted racemes.

1. **L. spica'ta,** Lam. (THE SPIKED LOBELIA.) The pale blue flowers ½ in. long. Stem slender, simple, 1-3 ft. high, minutely pubescent below. Leaves barely toothed, the lower spatulate or obovate, the upper linear. Racemes naked.

2. **L. infla'ta,** L. (INDIAN TOBACCO.) The pale blue flowers ⅛ of an inch long. Stem leafy, branching, 8-18 in. high, pubescent. Leaves ovate, or oblong, toothed. Raceme leafy.

ORDER XXX. **ERICA'CEÆ.** (HEATH FAMILY.)

Shrubs, sometimes herbs, with the flowers regular or nearly so, stamens as many or twice as many as the 4-5 lobed or 4-5 petalled corolla, free from but inserted with it; anthers 2-celled, commonly appendaged, or opening by terminal chinks or pores; style 1, ovary 3-10 celled. White flowers tinged with red.

SUB-ORDER I. *Calyx-tube, adherent to the ovary, forming an edible berry or berry like fruit.*

Gaylussa'cia. Ovary 10-celled. Stamens 10, anthers awnless, opening by a pore. Corolla tubular or bell-shaped, border 5-cleft.

G. resino'sa, Torr. and Gr. (BLACK HUCKLEBERRY.) Fruit black without a bloom. Racemes short, 1-sided, clustered. Leaves oval or oblong, with shining resinous globules; 1-3 ft. high. Flowers white, tinged with purple.

Vaccin'ium. Berry 4-5 celled or imperfectly 8-10 celled; stamens 8-10, the cells separate and prolonged into a tube, opening by a pore at the apex. Solitary, clustered or racemed flowers. Corolla white or reddish, revolute and 4-parted.

1. **V. Pennsylvanicum,** Lam. (DWARF BLUEBERRY.) From 6-15 in. high, branches green, angled and warty. Corolla bell-shaped, 5 toothed. Flowers in racemes. Leaves lanceolate or oblong, serrate, smooth and shining. Berry bluish-black, glaucous.

2. **V. Canaden'se,** Kalm. (CANADIAN BLUEBERRY.) Low, 1-2 ft. high. Leaves oblong-lanceolate or elliptical, entire, downy both sides as well as the crowded branchlets.

3. **V. oxyco'ccus,** L. (SMALL CRANBERRY.) A creeping, slender plant, 4-9 in. long with ovate, acute, evergreen leaves,

¼ in. long, margins revolute. Corolla rose colored, 4 parted, lobes reflexed. Berry speckled when young.

4. **V. macrocarpon,** Ait. (LARGE CRANBERRY.) Stems 1–4 ft. long, the flowering branches ascending. Leaves oblong obtuse, less revolute, ⅓–½ in. long; pedicels lateral.

Chiogenes. Stamens 8, inserted on an 8-toothed disk; anther cells pointed at the apex, opening by a chink. Flowers very small with two bractlets under the calyx. Berries bright white.

5. **C. serphyllifo'lia,** Salisb. (CREEPING SNOWBERRY.) Leaves about ⅓ in. long. Flowers small and solitary in the axils.—Peat bogs.

SUB-ORDER II. *Calyx free from the ovary. Corolla gamopetalous, rarely polypetalous, hypogynous.*

Arctostaphylos. Corolla urn-shaped, limb 5-toothed, revolute. Stamens 10, each anther with 2 reflexed awns on the back opening by terminal pores. Leaves alternate.

6. **A. uva-ursi** Spreng. (BEARBERRY.) Trailing. Flowers nearly white in racemes or clusters. Leaves obovate or spatulate, entire, smooth. Fruit red.

Epigæa. Corolla salver-shaped, hairy inside, rose-colored. Stamens 10, anthers awnless, opening lengthwise. Calyx of 5 pointed and nearly distinct sepals.

7. **E. repens,** L. (MAY FLOWER. TRAILING ARBUTUS.) Flowers appearing in early spring, fragrant. Heart-shaped and alternate leaves. A prostrate or trailing, scarcely shrubby plant.

Gaultheria. Corolla ovoid, 5-toothed, nearly white. Stamens 10, anthers 2-awned, opening by a terminal pore. Capsule enclosed when ripe by the calyx, which becomes a fleshy red berry.

8. **G. procum'bens,** L. (CREEPING WINTERGREEN.) Stems creeping on or below the surface. Flowering branches, leafy at the summit, 3–5 in. high. Leaves obovate or oval, scarcely serrate. Flowers nearly white, solitary. Pedicels with 2 bractlets.—Cool woods.

Cassandra. Corolla cylindrical, 5-toothed. Stamens 10, anther cells with a pore at the apex, awnless. Calyx of 5 overlapping sepals.

and 2 similar bractlets. Pod with a double perianth, the outer of 5 valves, the inner of 10 valves.

9. **C. calycul'ata,** Don. (LEATHER-LEAF.) Flowers white, in 1-sided leafy racemes. Leaves oblong, obtuse, scurfy. —Bogs. About 2 ft. high.

Cal'luna. Calyx of 4 colored sepals; corolla bell-shaped, 4-parted, shorter than the calyx, both becoming scarious. Stamens 8. Evergreen shrub with crowded, opposite and minute leaves with base extended into auricles.

10. **C. vulgaris,** Salisb. (HEATHER.) Flowers forming close, mostly 1-sided spikes or spike-like racemes, rose-colored or sometimes white.

Kalmia. Corolla broadly bell-shaped, 5-lobed, furnished with 10 depressions in which the 10 anthers are lodged. Filaments long and threadform. Shrubs with showy flowers.

11. **K. angustifolia,** L. (SHEEP LAUREL. LAMBKILL.) From 1 3 ft. high. Leaves opposite or in 3's, green above, pale underneath, oblong, obtuse, petioled. Pedicels recurved in fruit.

12. **K. glauca,** Ait. (PALE LAUREL.) Branchlets 2-edged; leaves opposite, oblong, white-glaucous beneath with revolute margins, 1 ft. high. Flowers lilac-purple.

Rhododen'dron. Corolla lobed, cleft, or somewhat irregular. Calyx small, stamens as many, or twice as many as the corolla lobes; anthers opening by a terminal pore.

13. **R. Rhodora,** Don. (RHODORA OR ROSE BAY.) Young parts sparingly strigose-hairy, 1 2 ft. high. Leaves oblong, pale. Corolla hardly 1 in. long, purplish-rose color, bilabiate. Early flowering.—In cool bogs.

Le'dum. Calyx 5-toothed, small; petals obovate, distinct. Stamens 5 10; anthers opening by terminal pores. Capsule splitting from the base upwards. The alternate entire leaves clothed with rusty wool underneath; margins revolute.

14. **L. latifolium,** Ait. (LABRADOR TEA.) Shrub 1 3 ft. high; leaves oblong or linear-oblong, 1 2 in. long, very obtuse. Capsule oblong; stamens 5 7.—In cold bogs.

SUB ORDER III. *Calyx free from the ovary. Corolla poly petalous.*

Moneses. Petals 5, widely spreading, orbicular; anthers conspicuously 2-horned; stigma large, peltate, with 5 narrow and radiating lobes. Scape 1 flowered.

1. **M. grandiflora,** Salisb. (ONE-FLOWERED PYROLA.) Leaves rounded, veiny and serrate; the 1-2 bracted scape 2-4 in. high, bearing a white or rose-colored terminal flower.

Pyrola. Calyx 5-parted; petals 5, concave and more or less converging. Stamens 10, filaments awl shaped. Style generally long; stigma 5 lobed or 5 rayed. Flowers racemed.

2. **P. secunda,** L. Leaves ovate, thin, longer than the petiole, finely serrate; raceme spike-like; flowers turned to one side, greenish white. Calyx lobes ovate, shorter than the oblong-oval petals. Style long, exserted.

3. **P. chlorantha,** Swartz. Leaves small, 1 in. long, roundish, shorter than the petiole; scape few-flowered, 5-8 in. high. Calyx-lobes roundish-ovate, very short; the elliptical greenish-white petals, converging. Style little exserted.

4. **P. elliptica,** Nutt. (SHIN-LEAF.) Leaves elliptical or obovate-oval, longer than the margined petiole. Raceme many-flowered; calyx-lobes ovate, acute, $\frac{1}{4}$ the length of the greenish-white petals.

5. **P. rotundifolia,** L. Leaves orbicular, thick, shining, usually shorter than the petiole. Calyx-lobes lanceolate or oblong-lanceolate, acutish, $\frac{1}{2}$ or $\frac{1}{3}$ the length of the roundish, obovate, white petals. Scape many-bracted, 6-12 in. high, raceme many-flowered.

SUB ORDER IV. *Plants herbaceous, root-parasitic, entirely destitute of green foliage.*

Monotropa. Calyx of 2-5 lanceolate, bractlike scales. Corolla of 4-5 separate, spatulate or wedge-shaped, scale-like petals. Stamens 8 or 10, anthers kidney-shaped, opening across the top. Stigma disk-like, 4 or 5 rayed.

1. **M. uniflora,** L. (INDIAN PIPE. CORPSE-PLANT.) Smooth, waxy-white, 3-8 in. high; turning black in drying. In dark, rich woods.

2. **M. Hypo'pitys,** L. (PINE SAP. FALSE BEECH DROPS.) Somewhat downy, tawny whitish or reddish, 4–12 in. high. Style longer than the ovary, bidfid. Oak and pine woods.

ORDER XXXI. **PLUMBAGINA'CEÆ.** (LEADWORT FAMILY.)

Maritime herbs, with regular 5-merous flowers, a plaited calyx, the 5 stamens opposite the separate petals or the lobes of the corolla; and the free ovary 1-celled.

Statice. Flowers loosely spiked and 1-sided on the branches, 2-3 bracted. Calyx funnel-form. Corolla of 5 nearly or quite distinct petals, the 5 stamens attached to their bases. Styles 5, rarely 3, separate.

S. Limo'nium, L. (SEA-LAVENDER. MARSH ROSEMARY.) The Var. Carolinia'na, Gray, is the plant of this Province, found on our salt marshes. It has very acute, or acuminate calyx-lobes. Root thick and woody, very astringent. Leaves oblong, spatulate, or obovate-lanceolate, 1-ribbed, petioled. Scape branched, 1–2 ft. high. Spikelets 1–3 flowered; flowers lavender-color.

ORDER XXXII. **PRIMULA'CEÆ.** (PRIMROSE FAMILY.)

Herbs with simple leaves, and regular perfect flowers, the stamens as many as the lobes of the monopetalous, rarely polypetalous, corolla, and inserted opposite them, and a 1-celled ovary with a central free placenta. Style 1.

Trientalis. Leaves in a whorl at the summit of a slender stem. Calyx and corolla mostly 7-parted, the latter spreading, without a tube. White.

1. **T. America'na,** Pursh. (STAR-FLOWER.) Leaves elongated-lanceolate tapering to both ends; petals finely pointed.

Lysimachia. Corolla rotate, calyx 5-7 parted. Flowers yellow, axillary or in a raceme.

2. **L. thyrsiflora,** L. (TUFTED LOOSESTRIFE.) Flowers purplish-dotted, in spike-like clusters. Leaves scale-like below, the upper lanceolate, opposite, sessile, dark dotted.

Glaux. Calyx bell-shaped, 5-cleft; corolla wanting. Stamens alternate with the lobes of the purplish calyx.

3. **G. maritima,** L. (SEA-MILKWORT.) Leaves opposite, oblong, entire, sessile. Flowers solitary in the axils. Sea shore.

Anagallis. Calyx 5-parted; corolla rotate; longer than the calyx. Stamens 5, filaments bearded.

4. **A. arvensis,** L. (COMMON PIMPERNEL.) Leaves ovate, sessile, shorter than the pedunicles. Petals fringed with minute teeth or stalked glands. Flowers scarlet, purple, blue or white.

Samolus. Corolla bell-shaped, 5-parted with 5 sterile filaments in the sinuses. Flowers very small, racemed, white.

5. **S. Valera'ndi,** L. Var. Americanus, Gr. (BROOK WEED.) Stem slender, diffusely branched. Leaves obovate or spatulate, racemes panicled, pedicels long and spreading.

ORDER XXXIII. **OLEA'CEÆ.** (OLIVE FAMILY.)

Trees or shrubs with opposite and pinnate or simple leaves, a 4-cleft or sometimes obsolete calyx. A regular 4-cleft or 4-petalous corolla, sometimes apetalous. Stamens 2, 4; ovary 2-celled.

Fraxinus. Leaves pinnate; flowers polygamous or dioecious without petals and mostly without a calyx. Stamens 2, with large oblong anthers.

1. **F. America'na,** L. (WHITE ASH.) Leaflets 7-9 petioled; ovate, pointed, entire or sparingly serrate. Bark gray and furrowed.

2. **F. sambucifo'lia,** Lam. (BLACK ASH.) Leaflets 7-11, oblong-lanceolate, tapering to a point, serate, sessile. Swamps.

ORDER XXXIV. **APOCYNACEÆ.** (DOGBANE FAMILY.)

Plants with milky, acrid juice and entire, chiefly opposite leaves without stipules, regular pentamerous and pentandrous flowers; the filaments distinct and on the corolla. Calyx free from the two ovaries.

Apocynum. Corolla bell-shaped; 5-cleft, bearing 5 triangular appendages below the throat opposite the lobes; stamens 5 on the base of the corolla.

A. androsæmifo'lium, L. (SPREADING DOGBANE.) Smooth, branched above, branches forking. Leaves ovate, distinctly petioled. Cymes mostly longer than the leaves. Corolla pale rose-color, with revolute lobes.

ORDER XXXV. **BORAGINA'CEÆ.** (BORAGE FAMILY.)

Rough, hairy herbs, with a deeply 4-lobed ovary, forming 4 seed-like nutlets, but the corolla is regularly 5-lobed, with 5 stamens on its tube. Style 1.

Myosotis. Corolla short, salver-form, its lobes rounded, the throat crested.

M. laxa, Lehm. (FORGET-ME-NOT.) Stems slender, decumbent; leaves lanceolate-oblong or slightly spatulate. Calyx-lobes as long as its tube. Corolla pale blue.

ORDER XXXVI. **CONVOLVULA'CEÆ.** (CONVOLVULUS FAMILY.)

Twining or trailing herbs, with alternate leaves and regular flowers. Sepals 5; corolla 5-lobed. Flowers mostly showy on axillary peduncles. Pedicels articulated.

Convo'lvulus. Style undivided or 2-cleft at the apex. Stigmas 2, linear-filiform to subulate or ovate.

C. sepium, L. (HEDGE BINDWEED.) Stem twining or trailing. Leaves triangular-halberd-shaped or sagittate, acute or pointed. Peduncles 4-angled.

ORDER XXXVII. **SOLANA'CEÆ.** (NIGHTSHADE FAMILY.)

Herbs, or rarely shrubs, with colorless juice and alternate leaves. Regular pentamerous and pentandrous flowers. Fruit a many-seeded berry or pod.

Solanum. Anthers opening by pores at the tip, connivent. Corolla rotate, 5-lobed or nearly entire. Stamens exserted.

1. **S. nigrum,** L. (COMMON NIGHTSHADE.) Much branched and spreading, nearly glabrous, rough on the angles; leaves ovate, wavy-toothed. Flowers white, in small lateral clusters. Berries globular, black.

Nica'ndra. Calyx 5-parted, enlarged and bladder-like in fruit, enclosing the globular, dry berry. Corolla with border nearly entire.

2. **N. physaloi'des,** Gaertn. (Apple of Peru.) Annual, 2–3 ft. high, with ovate, sinuate-toothed or angled leaves and solitary pale-blue flowers.

Datu'ra. Calyx prismatic, 5-toothed. Corolla funnel-form with a large and spreading 5-10 toothed border. Stigma 2-lipped. Capsule globular and prickly.

3. **D. Stramo'nium,** L. (Thorn-Apple.) Leaves ovate, sinuate-toothed or angled; stem green; corolla white, 3 in. long, the border with 5 teeth.

Order XXXVIII. **SCROPHULARIA'CEÆ.** (Figwort Family.)

Chiefly herbs with didynamous stamens (or perfect stamens, often only 2, rarely 5), inserted on the tube of the 2-lipped or more or less irregular corolla. Fruit, a 2-celled capsule. Style 1, stigma entire or 2-lobed.

Verba'scum. Corolla rotate. Flowers racemose; stamens 5, all with anthers; and 3, or all with bearded filaments.

1. **V. Tha'psus,** L. (Common Mullein.) Densely woolly throughout, stem tall and stout, simple, winged by the decurrent bases of the leaves, oblong, acute; flowers yellow, in a prolonged spike.—Fields, common.

Linari'a. Corolla, personate, spurred at base; flowers in simple racemes, or axillary. Stamens 4.

2. **L. vulga'ris,** Mill. (Butter and Eggs.) Leaves linear, numerous, raceme dense. Corolla 1 in. long, yellow. Seeds winged.

Chelo'ne. Corolla tubular, inflated above. Stamens 4, and a fifth sterile filament; filaments and anthers woolly. Flowers white, in a spike.

3. **C. gla'bra,** L. (Turtle-Head.) Two feet or more high. Leaves lanceolate, 4–5 in. long, serrate with sharp teeth, petioled opposite. Corolla white, or barely tinged with rose.

Penste'mon. Corolla inflated, bell-shaped or 2-lipped, upper lip 2-lobed, lower 3-cleft. Stamens 4 and a fifth sterile filament, naked or bearded.

4. **P. pube'scens,** Solander. (BEARD-TONGUE.) Stem 1–2 ft. high; leaves oblong to lanceolate, 2–4 in. long, the radical ovate or oblong, corolla dull violet or purplish or partly whitish. Sterile filament yellow-bearded.

Mi'mulus. Stamens 4, all anther-bearing. Calyx 5-angled, 5-toothed. Upper lip of corolla erect, lower 3-lobed. Stigma 2-lobed.

5. **M. rin'gens,** L. (MONKEY-FLOWER.) Stem square, 1–2 ft. high; leaves oblong or lanceolate, pointed, clasping by a heart shaped base, serrate; peduncles longer than the violet-purple flower, corolla personate.

Limose'lla. Calyx 5-toothed, corolla open bell-shaped, 5-cleft, nearly regular. Leaves alternate or fascicled, fleshy. Marsh plant.

6. **L. aquatica,** L. var. tennifo'lia, Hoffm. (MUDWORT.) Leaves with no blade distinct from the petiole, awl-shaped or thread-form.

Vero'nica. Corolla rotate or salver-shaped, almost regular; stamens 2; leaves opposite or whorled; flowers racemed.

7. **V. Anaga'llis,** L. (WATER SPEEDWELL.) Leaves sessile, mostly clasping by a cordate base, ovate-lanceolate, acute, serrate or entire, 2–3 in. long. Corolla pale blue with purple stripes. Capsule slightly notched.

8. **V. America'na,** Schwein. (AMERICAN BROOKLIME.) Smooth, decumbent, then erect, 8–15 in. high; leaves mostly petioled, ovate or oblong, serrate, slightly cordate at base, slender pedicels spreading.

9. **V. officina'lis,** L. (COMMON SPEEDWELL.) Pubescent, prostrate; leaves short petioled, obovate-elliptical, obtuse, serrate; racemes dense, pedicel shorter than the calyx, pod notched. Corolla blue.

10. **V. serpyllifo'lia,** L. (THYME-LEAVED SPEEDWELL.) Nearly smooth, branches ascending, simple, 2–4 in. high; leaves oblong or ovate, the lowest petioled and rounded. Raceme loose; corolla whitish or pale blue with deeper stripes, pod obtusely notched.

11. **V. agre'stis**, L. (Field Speedwell.) Leaves round or ovate, crenate-toothed. Flower small; pod nearly orbicular, sharply notched, 1-2 seeded.

12. **V. Buxbau'mii**, Tenore. Leaves round or heart-ovate, crenate, 1 in. long. Flower large, ½ in. wide, blue, calyx-lobes lanceolate. Pod broadly notched, seeds 16-24.

Euphra'sia. Calyx 4-cleft; upper lip of corolla 2-lobed, sides folded back; lower lip 3-cleft, lobes obtuse or notched. Stamens 4, under the upper lip. Pod flattened.

13. **E. officina'lis**, L. (Eyebright.) Leaves ovate or lanceolate, lowest crenate. Lower lip of the whitish, yellowish or bluish corolla with lobes notched. Stamens 4.

Bar'tsia. Calyx 4-cleft; upper lip of corolla entire and sides not folded back. Stamens 4.

14. **B. Odonti'tes**, Huds. A span or two high, branching; leaves oblong, lanceolate, coarsely and remotely serrate; spikes loosely flowered. Corolla small, rose-red.

Rhinanthus. Calyx inflated, ovate; pod orbicular; seeds winged. Stamens 4.

15. **R. Crista'galli**, L. (Yellow-Rattle.) Leaves narrowly oblong, coarsely serrate. Floral bracts incised with bristle-tipped teeth. Corolla ½ in. long. The seeds when ripe rattle in the inflated calyx.

Melampyrum. Calyx 4-cleft, lobes sharp-pointed. Tube of corolla enlarged above; upper lip arched and compressed; the lower erect, 3-lobed at the apex. Stamens 4 under the upper lip.

16. **M. Americanum**, Michx. (Cow-Wheat.) Leaves lanceolate, short-petioled. Corolla greenish-yellow; the small seed like a grain of wheat.

Order XXXIX. **LABIA'TÆ.** (Mint Family.)

Chiefly herbs with square stems, opposite, aromatic leaves, more or less 2-lipped corolla, didynamous or diandrous stamens, and a deeply 4-lobed ovary, which forms in fruit 4 seed-like nutlets or achenes surrounding the base of the single style. Upper lip of the corolla 2-lobed, sometimes entire; the lower 3-lobed. Style 2-lobed at the apex.

* *Flowers in more or less crowded clusters, axillary or spicate. Corolla almost equally 4-lobed. The 4 stamens nearly equal.*

Mentha. Calyx 5-toothed, corolla with the bell-shaped border having the upper lobe broadest, entire or notched. Stamens 4, equal.

1. **M. Canaden'sis,** L. (WILD MINT.) Leaves varying from ovate oblong to lanceolate, tapering at both ends. Hairs on the stem not conspicuously reflexed. Flowers in axillary clusters, pale purplish.

Ly'copus. Fertile stamens 2; corolla nearly equally 4-lobed. Nutlets with thickened margins. Flowers white.

2. **L. Virgi'nicus,** L. (BUGLE-WEED.) Stem obtusely 4-angled, 6-20 in. high. Leaves ovate-lanceolate, toothed, entire towards the base, acuminate at both ends.

3. **L. sinua'tus,** Ell. Stem 1-3 ft. high, acutely 4-angled; leaves oblong or lanceolate, 1½-2 in. long, acuminate, irregularly incised or sinuate.

** *Stamens 4, the upper pair longer. Corolla 2-lipped; the upper lip concave or arched, the lower spreading.*

Ne'peta. Calyx tubular, often incurved, obliquely 5-toothed. Corolla with the upper lip erect, rather concave, notched or 2-cleft.

4. **N. Cata'ria,** L. (CATNIP.) Downy, erect, branched; leaves cordate, oblong, deeply-crenate, whitish-downy underneath. Corolla whitish, dotted with purple.

5. **N. Glecho'ma,** Benth. (GROUND IVY.) Creeping and trailing; leaves petioled, round kidney-shaped, crenate, green both sides; corolla thrice the length of the calyx, light blue.

*** *Stamens 4, ascending and parallel. Calyx bilabiate, the rounded lips entire. Corolla bilabiate, upper lip arched.*

Scutella'ria. The upper lip of calyx with a helmet-like appendage on the back.

6. **S. lateriflo'ra,** L. (MAD-DOG SKULLCAP.) Smooth; stem upright, much branched, 1-2 ft. high. Leaves lanceolate-ovate, pointed, coarsely serrate, petioled, 2-3 in. long. Flowers blue.—Wet places.

7. **S. galericula'ta,** L. (SKULLCAP.) Flowers solitary in the axils of the upper leaves. Smooth or a little downy,

1-2 ft. high. Leaves ovate-lanceolate, acute, serrate, slightly cordate at base. Corolla, violet-blue. Wet, shady places.

* * * *Stamens 4, parallel and ascending under the galeate or concave upper lip, the lower pair longer, except in* **Leonurus.**

Brunella. Calyx nerved and veiny; upper lip flat, 3-toothed, the lower 2-cleft. Corolla 2-lipped, upper lip arched, entire; the lower 3-cleft.

8. **B. vulgaris,** L. (Common Self-Heal or Heal-All.) Leaves ovate-oblong, entire or toothed, petioled, hairy or smoothish. Corolla violet, not twice the length of the purplish calyx.—Woods and fields.

Leonu'rus. Calyx top-shaped, the spiny-pointed teeth soon spreading. Nutlets truncate and acutely 3-angled at top.

9. **L. Cardiaca,** L. (Common Motherwort.) Tall, leaves long-petioled, the lower rounded, palmately-lobed; the floral emeate at base, 3-cleft, the lobes lanceolate. Upper lip of pale purple corolla bearded.

Galeo'psis. Calyx tubular-bell-shaped; the 5-teeth spiny-pointed. Anthers transversely 2-valved, the smaller valve ciliate.

10. **G. Tetra'hit,** L. (Common Hemp-Nettle.) Stem swollen below the joints, bristly-hairy; leaves ovate, coarsely serrate; corolla purplish or variegated, twice the length of the calyx, often with a purple spot on the lower lip.

Sta'chys. Calyx tubular-bell-shaped, equally 5-toothed or the 2 upper teeth united into one. Nutlets rounded at top. Upper lip of corolla often arched, entire or nearly so; the lower longer, 3-lobed, the middle lobe largest.

11. **S. palustris,** L. (Marsh Hedge Nettle.) Stem 4-angled, 2-3 ft. high, hirsute with reflexed hairs, especially on the angles. Leaves sessile or the lower short-petioled, oblong or ovate-lanceolate, serrate, rounded at base, downy. Whorls 6-10 flowered. Flowers purple.

Order XL. **PLANTAGINA'CEÆ.** (Plantain Family.)

Chiefly stemless herbs, with regular 4-merous spiked flowers, the stamens inserted on the tube of the dry and membranaceous, veinless, monopetalous corolla, alternate with its lobes.

Plantago. Calyx of 4 imbricated persistent sepals. Corolla salver form or rotate, withering on the pod, the border 4-parted. Stamens 4; style and long hairy stigma single, filiform. Leaves ribbed.

1. **P. major,** L. (Common Plantain.) Smooth or hairy; leaves ovate, oblong or oval, abruptly narrowed into a channeled petiole, spike dense, obtuse; sepals round-ovate or obovate. Seeds angled, reticulated. Pod 8-18 seeded.

2. **P. lanceolata,** L. (Ribgrass. English Plantain.) Hairy, scape grooved-angled. Leaves lanceolate, slender, 9-24 in. long. Bract and sepals scarious, brownish. Seeds 2, hollowed on the face.

3. **P. decipiens,** Barneoud. (Marsh Plantain.) Annual, sometimes biennial, with a stout rootstock, smooth, or scape pubescent, leaves flattish and channeled, nearly as long as the scape, 5-12 in., acuminate; spike slender, loose. — Salt marshes.

III. APETALOUS DIVISION.

DICOTYLEDONOUS PLANTS.

Flowers destitute of corolla and sometimes also of calyx.

Order XLI. **ILLECEBRA'CEÆ.** (Knotwort Family.)

Herbs, with mostly opposite and entire leaves, scarious stipules (in Scleranthus none); a 4-5 toothed or parted herbaceous or coriaceous persistent calyx, no petals, stamens on the calyx as many as the lobes, and opposite them or fewer; styles 2, often united. Small diffuse and tufted herbs, with small greenish or whitish flowers in clusters.

Scleranthus annuus, L. (Knawel.) Sepals 5, united below in an indurated cup. Stamens 10 or 5. Styles 2, distinct. Much branched and spreading, 3 to 5 in. high; flowers sessile in the forks. Calyx-lobes scarcely margined.

Order XLII. **AMARANTHACEÆ.** (Amaranth Family.)

Weedy herbs with nearly the characters of the Goosefoot Family, but the flowers mostly imbricated, with dry and scarious persistent bracts, the bracts often colored, commonly 3 in number; the 1-celled ovary 1-ovuled.

Amarantus. Flowers monœcious or polygamous, 3-bracted. Calyx of 5 or sometimes 3 equal erect sepals, glabrous. Stamens 5, rarely 2 or 3, separate; anthers 2-celled. Stigmas 2 or 3. Fruit an ovoid 1-seeded utricle, 2-3-beaked at the apex, mostly longer than the calyx, opening transversely or sometimes bursting irregularly.

1. **Amara'nthus retrofle'xus,** L. (Pigweed.) Roughish; leaves dull green, long-petioled, ovate or rhombic-ovate, undulate; the thick spikes crowded in a stiff panicle; bracts awn-pointed, rigid, exceeding the acute or obtuse sepals. Cultivated ground.

Acnid'ia. Characters of Amarantus except that the flowers are dioecious and the pistillate ones without calyx. Bracts 1-3, unequal. Staminate calyx of 5 thin oblong, mucronate-tipped sepals, longer than the bracts; stamens 5, stigmas 2-5, often long and plumose-hispid.

2. **A. tubercula'ta,** Moq. Var. **subnu'da,** Watson. (Water-Hemp.) Erect or often prostrate, the lower clusters at least of pistillate flowers, more or less cymose and often in globose heads; bracts thinner, narrow and lax, shorter than the fruit.

Order XLIII. **CHENOPODIA'CEÆ.** (Goosefoot Family.)

Chiefly herbs of homely aspect, with succulent and alternate leaves and small greenish flowers, mostly in interrupted spikes. Stamens usually as many as the lobes of the calyx and opposite them. Ovary 1-celled; stigmas mostly 2.

Chenopo'dium. Weeds with usually mealy leaves and greenish sessile flowers. Calyx 5-cleft; stamens mostly 5.

1. **Chenopodium album,** L. (Lamb's Quarters.) Stem 1-3 ft. high. Leaves from rhombic-ovate to lanceolate, toothed, mealy, as are the flower clusters.—Common in cultivated soil.

2. **C. urbicum,** L. Pale and slightly mealy, 1-3 ft. high, branches erect. Leaves triangular, acute, coarsely and sharply many toothed. Spikes crowded in a narrow, racemose panicle. In towns.

3. **C. rubrum,** L. (COAST BLITE.) Stem angled, much branched. Leaves thickish, acuminate, the upper linear-lanceolate, lower triangular-lanceolate. Flowers clustered in axillary, leafy spikes. Stamen 1.

Atriplex. Flowers monœcious or diœcious, the staminate with a regular calyx in spiked clusters; the pistillate without a calyx but with a pair of bracts.

1. **A. patulum,** L. Var. **littorale,** Gray. Dark green, glabrous or scurfy; slender. Leaves linear-lanceolate to linear, rarely subhastate or toothed.

Salicornia. Low saline plants with fleshy, leafless, jointed stems and opposite branches. Flowers perfect, spiked 3 together, sunk in each hollow of the fleshy axis of the spike. Calyx small and bladder-like with a toothed or torn margin.

5. **S. herbacea,** L. (SAMPHIRE.) Flowers embedded in hollows on the thickened upper joints, forming an elongated spike. Calyx small, its margin toothed. Stamens 1 or 2. Styles 2. Salt marshes.

Suæda. Fleshy saline plants, with alternate, terete, linear leaves. Flowers perfect, sessile in the axils of leafy bracts. Calyx 5-parted, very fleshy. Stamens 5, anthers exserted. Stigmas 2 or 3.

6. **S. linearis,** Moq. (SEA-BLITE.) Prostrate, or usually erect, 1-2 ft. high. Leaves narrow at the base, acute. Floral bracts acuminate. Anthers exserted. Styles united at the base.

Salsola. A diffusely branching annual, with alternate awl-shaped prickly-pointed leaves.

7. **S. Kali,** L. (SALTWORT.) Flowers perfect, sessile, with 2 bractlets, single in axils of leaves. Calyx 5-parted, enclosing the depressed fruit. Stamens 5. Sandy seashore.

ORDER XLIV. **POLYGONACEÆ.** (BUCKWHEAT FAMILY.)

Herbs with alternate, entire leaves, and stipules in the form of sheaths above the swollen joints of the stems; the flowers

mostly perfect with a more or less persistent calyx, a 1-celled ovary bearing 2 or 3 styles or stigmas and a single seed.

Rumex. Calyx of 6 sepals; the 3 outer herbaceous, sometimes united at the base, spreading in fruit; the 3 inner larger, somewhat colored, enlarging after flowering (in fruit called valves) and convergent over the 3-angled achene, often bearing a grain like tubercle on the back. Stamens 6. Styles 3; stigmas tufted.

1. **R. crispus,** L. (CURLED DOCK.) Smooth, 3-4 ft. high; leaves with strongly wavy, curled margins, lanceolate, acute, the lower truncate or scarcely heart-shaped at base. Whorls crowded in wand-like racemes, leafless above; valves round heart-shaped, denticulate or entire, mostly all grain bearing. In waste and cultivated ground.

2. **R. obtusifo'lius,** L. (BITTER DOCK.) Stem rough; lowest leaves ovate, heart-shaped, obtuse, rather downy on the veins beneath; the upper oblong-lanceolate, acute. Whorls loose, distinct. Valves somewhat halberd-shaped, deeply toothed at the base; one usually grain-bearing.

3. **R. sanguineus,** L. Leaves oblong lanceolate, often fiddle shaped, wavy-margined. Whorls distant, in slender, leafless spikes. Valves oblong, narrow, obtuse. Veins of the leaf red or green.

4. **R. aceto'sella,** L. (SHEEP SORREL.) Stem 6-12 in. high. Flowers [illegible] a terminal naked panicle. Herbage sour, leaves halberd-shaped.—In poor soil, common.

Poly'gonum. Sepals 5, sometimes 4, often colored and petal-like, persistent, embracing the 3-angled or flattish nutlet. Flowers generally in racemes or spikes.

5. **P. aviculare,** L. (KNOTGRASS, GOOSEGRASS.) Stem prostrate and spreading. Stamens chiefly 5. Achene 3-sided, dull. Leaves sessile, lanceolate; sheaths torn.—In yards and waste places.

6. **P. lapathifo'lium,** L. Annual, branching, 1-4 ft. high. Sheaths not fringed. Leaves long, tapering to a narrow point, rough on midrib and margin. Spikes oblong. Stamens 6 styles 2; achene flat.—In muddy places.

7. **P. Pennsylva'nicum,** L. Sheaths not fringed. Stem 1–3 ft. high, the upper branches and the peduncles bristly, with stalked glands. Stamens 8. Achene flat.—Low grounds.

8. **P. amphi'bium,** L. (WATER PERSICARIA.) Spikes of flowers dense, showy rose-red. Stem floating in shallow water or rooting in soft mud, nearly glabrous. Leaves long-petioled, often floating. Sheaths not bristly-fringed. Stamens 5; stigmas 2.

9. **P. Persica'ria,** L. (LADY'S THUMB.) Sheaths with a ciliate border. Stem nearly smooth, 12 or more inches in height. Leaves with a dark blotch on the middle of the upper surface. Stamens 6. Achene flat or 3-angled.—Common near dwellings.

10. **P. hydro'piper,** L. (COMMON SMARTWEED.) Annual, 1–2 ft. high, smooth, leaves narrowly to linear-lanceolate, sometimes oblong, punctate, spikes nodding, short or interrupted; flowers mostly greenish; stamens 6, sepals dotted; style 2–3 parted; achene minutely striate.—Wet grounds.

11. **P. a'cre,** H. B. K. (WATER SMARTWEED.) Sheaths fringed with bristles. Leaves transparent, dotted. Stem decumbent, 2–4 ft. high in muddy soil. Leaves taper-pointed, narrow. Flowers whitish or flesh-color. Stamens 8; style mostly 3-parted. Achene 3-angled.

12. **P. Virginia'num,** L. Upright, 2–4 ft. high. Sheaths cylindrical, hairy and fringed. Leaves ovate or ovate-lanceolate, taper-pointed, rough-ciliate. Flowers in long naked spikes. Calyx green, unequally 4-parted. Stamens 5. Styles 2, persistent on the achene.

Climbing by reflexed prickles on the angles of the stem. Sepals pale rose.

13. **P. arifo'lium,** L. (HALBERD-LEAVED TEAR-THUMB.) Stem grooved, leaves halberd-shaped, long-petioled. Flowers in short racemes. Stamens 6, achene flattish.

14. **P. sagitta'tum,** L. (ARROW-LEAVED TEAR-THUMB.) Stem 4-angled, angles beset with reflexed prickles, climbing. Leaves arrow-shaped. Stamens 8. Achenes 3-angled.

15. **P. convol'vulus,** L. (BLACK BINDWEED.) Twining or procumbent, low, roughish, the joints naked. Leaves halberd, heart-shaped, pointed; flowers in racemes. Outer calyx lobes keeled. Stem not prickly.

Fagopy'rum. Calyx 5-parted, petal-like. Stamens 8 with 8 yellow glands between. Styles 3, achenes 3-angled. Flowers white, in panicles. Leaves triangular heart-shaped or halberd-shaped.

16. **F. esculen'tum,** Moench. (BUCKWHEAT.) Old fields and copses remaining after cultivation. Achene smooth; acute.

ORDER XLV. EUPHORBIACEÆ. (SPURGE FAMILY.)

Plants usually with a milky, acrid juice and monœcious or dioecious flowers, mostly apetalous, sometimes achlamydeous; stigmas or branches of the style as many, or twice as many, as the cells.

Euphor'bia. Flowers monœcious, included in a cup-shaped 4-5 lobed involucre resembling a calyx or corolla, and usually bearing large thick glands at its sinuses. Sterile flowers numerous, each of a single naked stamen from the axil of a minute bract. Fertile flowers only one in each involucre; ovary 3-lobed, soon protruded on a long pedicel. Styles 3, each 2-cleft.

1. **E. polygonifolia,** L. Leaves entire, oblong-linear, mucronate, very smooth, stipules bristly-fringed. Peduncles in the forks. Glands of the involucre very small, not petal like. Pods obtusely-angled.

Leaves without stipules or blotches; those of the stem alternate or scattered.

2. **E. helioscopia,** L. Umbel first 5-rayed, then with 3, and finally merely forked. Stem 6-12 in. high. Leaves obovate, rounded or notched at the apex, serrate. Pods smooth.

3. **E. Cyparissias,** L. Stems densely clustered; stem leaves linear; floral ones heart-shaped; umbel many-rayed. A garden escape, 6-10 in. high.

4. **E. Peplus,** L. Umbel 3-rayed, then forking. Glands long-horned. Leaves petioled, round-obovate, floral ones ovate. Stem 5-10 in. high. Seeds ash-colored, 2-grooved on the inner face.

Order XLVI. **URTICA'CEÆ.** (Nettle Family.)

Herbs, shrubs or trees with monoecious or dioecious flowers, or in the elms sometimes perfect flowers, with a regular calyx free from the 1-2 seeded ovary, which becomes a 1-seeded fruit. Stamens opposite the lobes of the calyx, equal or fewer.

Ulmus. Flowers preceding the leaves. Ovary 1-2 ovuled. Fruit winged all round. Flowers polygamous, purplish or yellowish, in lateral clusters.

1. **U. America'na,** L. (American or White Elm.) Leaves not rough above; obovate-oblong or oval, abruptly pointed, sharply and often doubly serrate, 2-4 in. long. Flowers in close fascicles. Calyx with 7-9 roundish lobes.

Urtica. Flowers monoecious or dioecious, clustered, the clusters mostly in racemes, spikes, or loose heads. Sepals 4, in both sterile and fertile flowers. Stigma a small sessile tuft. Achene flat, enclosed between the two larger sepals. Flowers green-ish. Plant armed with stinging hairs.

2. **U. gracilis,** Ait. (Nettle.) Stem slender, 2-6 ft. high. Leaves ovate-lanceolate pointed, serrate, 3-5-nerved from the base, nearly smooth, the long petioles with a few bristles. Flowers in spikes. Moist ground.

3. **U. urens,** L. Leaves elliptical or ovate, coarsely and deeply serrate with long spreading teeth. Flower clusters 2 in each axil, small and loose, plant 8-12 in. high.—Waste grounds.

Order XLVII. **MYRICA'CEÆ.** (Sweet Gale Family.)

Monoecious or dioecious shrubs, with both kinds of flowers in scaly catkins, and resinous, dotted, often fragrant leaves. Fruit a 1-seeded drupe or nut.

Myrica. Flowers solitary under a scale-like bract and with a pair of bractlets, in catkins, from axillary buds. Stamens 2-8. Fruit coated with grains of wax.

1. **M. Ga'le,** L. (Sweet Gale.) Shrub 3-5 ft. high; leaves wedge-lanceolate, serrate towards the apex, pale. Nuts in imbricated heads, 2-winged by the two thick ovate scales at the base. Borders of ponds.

2. **M. cerif'era,** L. (BAYBERRY OR WAX MYRTLE.) Leaves oblong lanceolate, entire, wavy toothed above, shining and resinous, dotted each side, fragrant. Nuts incrusted with white wax. Shrub 3–8 ft. high.

3. **M. asplenifo'lia,** Endl. (SWEET FERN.) Shrub 1–2 ft. high with sweet scented fern like linear lanceolate leaves; stipules half-heart-shaped.

ORDER XLVIII. **CUPULIFERÆ.** (OAK FAMILY.)

Monoecious trees or shrubs, with alternate, simple, straight veined leaves, deciduous stipules, the sterile flowers in catkins or capitate-clustered in the beech; the fertile solitary, clustered, spiked, or in scaly catkins; the 1 seeded nut with or without an involucre.

Betula. Sterile flowers 3 and bractlets 2, to each shield-shaped bract of the catkin, consisting each of a calyx of one scale bearing two 2-parted filaments, each division bearing an anther cell. Fertile flowers 2 or 3 to each 3-lobed bract, without bractlet or calyx, becoming a broadly winged nut. Outer bark separable in sheets.

1. **B. lenta,** L. (CHERRY BIRCH, BLACK BIRCH.) Bark of trunk dark brown, close, sweet, aromatic. Leaves ovate or oblong-ovate from a more or less heart-shaped base acuminate, sharply and doubly serrate all round, bright green above. Wood rose-colored, fine grained.

2. **B. lu'tea,** Michx. f. (YELLOW OR GRAY BIRCH.) Bark of trunk yellowish or silvery-gray, detaching in thin filmy layers; leaves 3–5 in. long, narrowish towards the base.

3. **B. populifo'lia,** Ait. (AMERICAN WHITE BIRCH.) Leaves triangular or deltoid, taper pointed truncate or nearly so at the broad base, smooth and shining both sides.

4. **B. papyrifera,** Marshall. (PAPER OR CANOE BIRCH.) Leaves ovate, taper pointed, heart-shaped at base, smooth and green above, sharply and unequally doubly serrate, 3–4 length of the petiole.

Alnus. Sterile catkins elongated and drooping, with 4 or 5 bractlets and 3, rarely 6 flowers upon each short-stalked shield-shaped

scale. Fertile catkins ovoid or oblong, the scales each 2-3 flowered with a calyx of 4 little scales adherent to the bracts of the catkin.

5. **A. viridis,** D.C. (Green or Mountain Alder.) Shrub 3-8 ft. high. Leaves round-oval or ovate, irregularly serrulate with very sharp and close-set teeth. Fruit with a thin wing.

6. **A. inca'na,** Willd. (Speckled or Hoary Alder.) Leaves broadly oval or ovate, rounded at base, whitened and often downy beneath. Stipules oblong-lanceolate. Fruit orbicular, wingless. Shrub 8-20 ft. high.

Corylus. Sterile flowers in drooping catkins. No calyx. Stamens 8, with 1-celled anthers and 2 small bractlets under each bract. Each nut enveloped by a leaflike or tubular fringed involucre. Fertile flowers terminating the new shoots.

7. **C. rostrata,** Ait. (Beaked Hazel-nut.) Shrub. The involucre is prolonged into a narrow tube much beyond the nut and is bristly hairy. Leaves ovate or ovate-oblong, pointed.

Quercus. Sterile flowers in slender, naked catkins, calyx 2-8 parted. Stamens 3-12. Fertile flowers consisting of a nearly 3-celled and 6-ovuled ovary, with a 3-lobed stigma, enclosed by a scaly involucre which becomes an indurated cup (cupule) around the base of the acorn.

8. **Q. rubra,** L. (Red Oak.) A large tree. Leaves moderately pinnatifid, lobes or teeth bristle-pointed, turning dark red in autumn. Cup saucer-shaped, very much shorter than the acorn.

Fagus. Sterile flowers in small heads on drooping peduncles, with deciduous scale-like bracts; calyx bell-shaped, 5-7 cleft; stamens 8-16; filaments slender. Fertile flowers usually in pairs at the apex of a short peduncle, invested by numerous awl-shaped bractlets, the inner coherent at base to form the 4-lobed involucre.

9. **F. ferruginea,** Ait. (American Beech.) Leaves oblong-ovate, taper-pointed, distinctly and often coarsely toothed, straight veined. Branches horizontal.

Order XLIX. **SALICA'CEÆ.** (Willow Family.)

Dioecious trees or shrubs with both kinds of flowers in catkins, one to each bract, without perianth; the fruit a 1-celled

and 2-4 valved pod, bearing numerous seeds furnished with long silky down. Leaves alternate undivided, with stipules.

Salix. Bracts or scales of the catkins entire. Sterile flowers of 3-10, mostly 2 stamens. Catkins appearing before or with the leaves.

1. **S. discolor,** Muhl. (GLAUCOUS WILLOW.) Leaves smooth and bright green above, soon smooth beneath, irregularly crenate serrate, closer towards the point, lanceolate or ovate-lanceolate. Scales brown, becoming black, clothed with long glossy hairs.

2. **S. humilis,** Marsh. (PRAIRIE WILLOW.) Leaves oblanceolate or oblong-lanceolate, the lowest obovate; stipules semi-ovate or moon-shaped, entire or toothed; petioles distinct; catkins often recurved, about 1 in. long. Shrub 3-8 ft. high.

Po'pulus. Bracts of the catkins cut-lobed at the apex. Stamens 8-30 or more under each scale. Leaves broad and more or less heart-shaped. Catkins drooping.

3. **P. tremuloides,** Michx. (AMERICAN ASPEN.) Tree 20-50 ft. high, with smooth, greenish-white bark; leaves roundish, heart-shaped, with a short, sharp point and small teeth, on long slender petioles. Constantly in a state of agitation.

4. **P. grandidenta'ta,** Michx. (LARGE-TOOTHED ASPEN.) Like the last, but the leaves are roundish ovate and with large sinnate teeth.

ORDER L. **EMPETRA'CEÆ.** (CROWBERRY FAMILY.)

Low shrubby evergreens with the foliage and aspect of Heaths.

Em'petrum. Flowers polygamous, scattered and solitary in the axils of the leaves, scaly-bracted. Calyx of 3 spreading and petal-like sepals. Stamens 3. Style short; stigma 6-9 rayed.

E. ni'grum, L. (BLACK CROWBERRY.) Procumbent and spreading; leaves linear-oblong, scattered; fruit black. Common on the coast east of St. Peter's.

SUB-CLASS II. GYMNOSPERMÆ.

Pistil represented by an open scale. The ovules and seeds naked.

ORDER LI. **CONI'FERÆ.** (PINE FAMILY.)

Trees or shrubs with resinous juice, mostly awl-shaped or needle-shaped leaves; monœcious or rarely diœcious flowers, destitute of calyx or corolla.

Fruit a true cone: ovules 2 on the inside of each scale.

1. **Pinus strobus,** L. (WHITE PINE.) Leaves in 5's, slender, glaucous; cones narrow, cylindrical, often curved, 4-6 in. long. Cones sub-terminal.

2. **P. resinosa,** Ait. (RED PINE.) Leaves in 2's from long sheaths, 4-6 in. long. Cones terminal, about 2 in. long.

3. **Pi'cea ni'gra,** Link. (BLACK SPRUCE.) Branchlets pubescent, leaves sessile, 4-sided, pointing in all directions. Cones hanging, persistent, ovate or ovate-oblong, mostly recurved. Scales with thin denticulate edges.—Swamps.

4. **P. alba,** Link. (WHITE SPRUCE.) Branchlets glabrous; cones nodding, cylindrical, deciduous, about 2 in. long; the thin scales with an entire edge.

5. **Tsuga Canadensis,** Carr. (HEMLOCK.) Leaves petioled, flat, lighter beneath, pointing in two directions, right and left, obtuse. Cones hanging, persistent.

6. **Abies balsamea,** Miller. (BALSAM FIR.) Leaves flat, the lower surface whitish and the midrib prominent, linear or needle-shaped, crowded, pointing right and left. Cones erect on the upper side of the branches, violet.

7. **La'rix America'na,** Michx. (AMERICAN LARCH.) Leaves slender, fascicled, falling off in autumn. A slender and graceful tree.

Fruit a small loose cone or a false berry.

8. **Thuja occidentalis,** L. (WHITE CEDAR. ARBOR VITÆ.) Leaves, some awl-shaped, others scale-like, imbricated on the flat branches.—Chiefly in Prince County.

9. **Juni'perus communis,** L. Var. **Alpina,** Gaud. (ALPINE JUNIPER.) Decumbent. Leaves in whorls of 3, rigid, prickly-pointed. Aments axillary.

10. **J. Sabi'na,** L. Var. **procumbens,** Pursh. (SAVIN, PROCUMBENT JUNIPER.) A prostrate or creeping shrub. Leaves

mostly opposite, awl-shaped and scale-shaped; the awl-shaped are loose, scale-shaped are appressed and acute. Aments terminal.

Fruit becoming berry-like, enclosing the seeds.

11. **Taxus Canadensis,** Willd. (American Yew. Ground Hemlock.) A low straggling bush, the stems spreading. Leaves linear, green both sides, 2-ranked and mucronate. Fruit pulpy and red.—Under evergreens.

Class II. Monocotyledonous or Endogenous Plants.

Stems with the woody fibre irregularly embedded in the cellular tissue. Leaves mostly parallel-veined, almost always alternate and not toothed. Parts of the flower commonly in threes.

Order LII. Orchidaceæ. (Orchid Family.)

Herbs distinguished by their perfect, irregular flowers, with 6-merous perianth adnate to the 1-celled ovary, and with 1 or 2 gynandrous stamens, the pollen cohering in masses. Perianth in 2 sets, each of 3 divisions, sepals and petals. One of the inner set differs in figure and direction from the others and is called the *lip*, the other two are known as petals. Before the lip, in the axis of the flower, is the *column*, with 1 or 2 stamens borne on the style or thick fleshy stigma, anther 2-celled.

Liparis. Sepals and petals nearly equal, linear; lip flat, entire, often bearing 2 tubercles above the base. Low herbs with solid bulbs, producing 2 root-leaves and a low scape.

1. **L. Loesel'ii,** Richard. (Twayblade.) Leaves elliptic-lanceolate or oblong; lip obovate or oblong, mucronate, yellowish-green, shorter than the linear, unequal petals and sepals.—Bogs.

Corallorhi'za. (Coral Root.) Leafless, with coralloid roots; plant brownish or yellowish; flowers racemose. The oblong or lanceolate sepals and petals nearly alike, 1-3 nerved, the upper arching.

2. **C. odontorhi'za,** Nutt. Plant light brown or purplish;

stem rather slender, bulbous, thickened at base, 6–16 in. high, 6–20 flowered; lip entire or denticulate, abruptly contracted into a claw-like base.

3. **C. multiflo'ra,** Nutt. Plant purplish, rather stout, 9–18 in. high, 10–30 flowered; lip deeply 3-lobed; spur manifest and protuberant. Pod short pedicled.

Spira'nthes. (LADIES' TRESSES.) Stem leafy below, from tuberous fascicled roots. Flowers white, 1-3 ranked in a twisted spike.

4. **S. Romanzoffia'na,** Cham. Stem leafy below and leafy bracted above, 5–15 in. high; leaves from oblong-lanceolate to grassy-linear, spike dense, oblong, 1–4 in. long; 2-horned beak of the stigma short.

5. **S. gracilis,** Bigel. Roots clustered: scape 8–18 in. high, bearing a slender, many-flowered twisted spike of 1-ranked flowers.

Goodye'ra. Lip sac-shaped, sessile, entire. Leaves in a tuft, thickish and petioled from a rootstock, usually reticulated with white veins. Scape, spike and greenish-white flowers usually glandular, downy.

6. **G. re'pens,** R. Br. (RATTLESNAKE-PLANTAIN.) Small, 5–8 in. high, slender; leaves ovate, more or less white-reticulated, 1 in. long. Flowers several in a 1-sided spike, lip with an ovate recurved tip; sepals ovate.

Calopogon. Leaf solitary, grasslike; lip bearded, stalked, free; column winged at the apex. Scape from a small, solid bulb, sheathed below by the leaf.

7. **C. pulchellus,** R. Br. Scape about 1 ft. high, 2–6 flowered, flowers 1 in. broad, pink-purple. Lip bearded with white, yellow and purple club-shaped hairs.—Bogs.

Pogonia. Leafy; lip crested, or 3-lobed. Column club-shaped, wingless.

8. **P. ophioglosso'ides,** Nutt. Sepals and petals nearly equal, alike, pale rose. Stem 6–9 in. high, bearing a single oval or lanceolate-oblong leaf near the middle and a smaller one near the terminal flower; lip appressed to the column.

Habenaria. (Rein Orchis.) Viscid disks to which the pollen masses are attached, naked and separate; the lateral sepals mostly spreading.

9. **H. tridenta'ta,** Hook. (THREE-TOOTHED REIN-ORCHIS.) Stem slender 6-12 in. high with a single oblong or oblanceolate obtuse leaf below and 2 or 3 small ones above. Spike 6-12 flowered, the small flowers whitish or greenish; lip with 3 short teeth at the apex, the upward curved spur longer than the ovary.—Bogs.

10. **H. orbicula'ta,** Torr. Leaves very large, 4-8 in. wide, orbicular, spreading flat on the ground, shining above, silvery beneath; scape bracted 1-2 ft. high, bearing many greenish white flowers in a raceme. Coniferous woods.

11. **H. blepharigio'ttis,** Torr. (WHITE-FRINGED ORCHIS.) Stem 1 ft., leaves oblong or lanceolate; flowers white, small; petals spatulate, usually toothed at the apex; lip ovate or lance-oblong, the margin with an irregular capillary fringe.

12. **H. leucophæ'a,** Gray. (GREENISH-FRINGED ORCHIS.) Stem 2-4 ft. high; leaves oblong lanceolate, bracts similar; spike elongated; petals obovate, minutely cut-toothed; divisions of the lip wedge-shaped or fan shaped, cleft to the middle into a copious thread-like fringe; flowers greenish or yellowish white.—Moist meadows.

13. **H. psyco'des,** Gray. (PURPLE-FRINGED ORCHIS.) Lip 3-parted above the base, divisions fringed. Flowers purple; leaves oblong or lanceolate, uppermost linear-lanceolate; raceme many-flowered, lower sepals [illegible]nd-oval, obtuse; petals wedge-obovate, denticulate above. [illegible]et meadows and bogs.

Cypripedium. Perfect anthers 2, the sterile anther forming a fleshy appendage above the terminal stigma. Stem leafy; lip an inflated sac.

14. **C. spectabile,** Salish. (SHOWY LADY'S SLIPPER.) Downy, 2 ft. high, leaves ovate, pointed, sepals round-ovate or orbicular, longer than the oblong petals, lip much inflated, white, pink-purple in front, 1½ in. long.

15. **C. acaule,** Ait. (STEMLESS LADY'S SLIPPER.) Scape 8-12 in. high, 2-leaved, 1-flowered, sepals and petals greenish;

leaves oblong; lip obovoid or oblong, rose-purple, nearly 2 in. long, veiny.

Order LIII. IRIDA'CEÆ. (Iris Family.)

Herbs with equitant 2-ranked leaves, and regular or irregular perfect flowers; perianth 6-cleft, petal-like. Stamens 3, distinct or monadelphous, alternate with inner divisions of the perianth, anthers extrorse.

Iris. Perianth 6-cleft, outer divisions recurved; inner erect, stigmas petal-like.

1. **I. versi'color,** L. (Larger Blue Flag.) Stem stout, angled on one side; leaves sword-shaped, ¾ in. wide; ovary obtusely triangular with the sides flat. Flowers short-peduncled, 2½–3 in. long; violet-blue.

Sisyrin'chium. Perianth 6 parted, the spreading divisions alike. Stamens monadelphous; stigmas thread-like. Pod 3-angled.

2. **S. angustifolium,** Mill. (Blue-eyed Grass.) Scape 4–12 in. high, winged or wingless, simple, the spathe solitary and terminal; flowers delicate blue, changing to purplish, the divisions of the perianth notched, bristle-pointed, ciliate.—Moist meadows.

Order LIV. LILIA'CEÆ.

Herbs, or rarely woody plants, with regular and symmetrical, almost always 6-androus flowers, the perianth free from the chiefly 3-celled ovary; the stamens one before each of its divisions, 6, in one instance 4, with 2-celled anthers; the outer and inner ranks of the perianth colored alike, except in Trillium.

A. *Floral bracts scarious; stamens perigynous; anthers introrse; style undivided, fruit a capsule or a berry.*

Smilacina. Stem simple, leafy; flowers 6-parted, spreading, white, in a terminal raceme.

1. **S. racemo'sa,** Desf. (False Spikenard.) Minutely downy, 1–3 ft. high; leaves numerous, oblong, or oval-lanceolate, taper-pointed ciliate; berries pale red, speckled with purple.

2. **S. stella'ta,** Desf. Plant 1 ft. high, nearly smooth, leaves 7 12, oblong-lanceolate, slightly clasping. Raceme simple. Berries black.

3. **S. trifo'lia,** Desf. Smooth stem, 2 6 in. Leaves usually 3, oblong-lanceolate, with a sheathing base. Raceme pedunculed. Berries red.—Cold bogs.

Mala'nthemum. Perianth 4-parted with as many stamens. Ovary 2-celled, stigma 2-lobed; flowers in a simple raceme.

4. **M. Canadense,** Desf. Pubescent or glabrous, 3 5 in. high; leaves lanceolate to ovate, cordate, sinus narrow, sessile or short petioled.—Moist woods.

B. *Floral bracts none or foliaceous; stamens hypogynous; anthers extrorse or dehiscent laterally; style undivided. Stem or scape from a creeping rootstock.*

Strep'topus. Stem leafy, flowers axillary on bent pedicels; anthers sagittate, acute, extrorse. Berry red.

5. **S. roseus,** Michx. (Twisted Stalk.) Lower leaves green both sides, finely ciliate and the branches sparingly beset with bristly hairs; flower rose-purple, anthers 2-horned. Stigma 3 cleft.

Clinto'nia. The 6 stamens inserted at the base of the separate petals. Anthers linear or oblong.

6. **C. borea'lis,** Raf. Scape and leaves 5 8 in. long; umbel 3 6 flowered; perianth greenish-yellow, somewhat downy outside, ⅓ in. long. Berry blue, ovules 20 or more.—Moist woods.

Mede'ola. Perianth recurved, the pale greenish-yellow sepals and petals oblong and alike. Stamens 6, anthers shorter than the filaments. Styles stigmatic.

7. **M. Virginia'na,** L. (Indian Cucumber-root.) Stem covered with loose wool 1 3 ft. high from a tuberous white rootstock, bearing 2 whorls of leaves. Flowers small, in an umbel. Berry dark-purple, 3-celled.

Trillium. Leaves 3, in a terminal whorl, net-veined. Sepals 3, lanceolate, herbaceous; petals 3, larger. Stamens 6, anthers linear, on short filaments. Berry 6-angled, purple or red.

8. **T. erec'tum,** L. Leaves broadly rhombic, 6 in. or less wide, short acuminate; pedicel inclined 1-3 in. long; petals

ovate to lanceolate, brown-purple, often white, greenish or pinkish; stamens equalling or exceeding the stout recurved stigmas. Fruit 1 in. long, reddish. Rare.

9. **T. cernuum,** L. Leaves broadly rhombic-ovate, 2-4 in. broad; petals white or pink, ovate to oblong-lanceolate, wavy. Stamens with anthers shorter than the stout recurved stigmas.

10. **T. erythrocar'pum,** Michx. (PAINTED T.) Leaves ovate, acuminate; petals ovate or oval-lanceolate, pointed, wavy, white, painted with purple stripes at the base, shorter than the peduncle. Fruit broad ovate, obtuse. Commonest of the Trilliums.

ORDER LV. JUNCA'CEÆ. (RUSH FAMILY.)

Grass-like or rush-like herbs, with small flowers, a regular and hypogynous perianth of 6 similar, glumaceous sepals, 6 or rarely 3 stamens; a short style, 3 filiform hairy stigmas and an ovary 3 or 1-celled.

Juncus. Capsule 3-celled or imperfectly so, many seeded. Plants never hairy, growing in moist ground or water. Stamens when 3, opposite the 3 outer sepals.

1. **J. effu'sus,** L. (COMMON or SOFT RUSH.) Scape soft and pliant, 2-4 ft. high, inner sheaths awned; panicle much branched, many-flowered; flowers small, greenish; sepals lanceolate, very acute. Seeds small with short, pale points.—Marshy ground.

2. **J. ten'uis,** Willd. Stem wiry 9-18 in. high, leaves flat or channelled; flowers, green, 1/6 in. long; sepals lanceolate, very acute, longer than the green capsule. Seeds small, delicately ribbed and cross lined.—Fields and roadsides.

Luzula. Capsule 1-celled, 3-seeded, perennials, often hairy, usually in dry ground, with flat and soft, usually hairy leaves and spiked or umbelled flowers.

3. **L. campestris,** DC. (WOOD RUSH.) Leaves flat, linear; spikes 4–12, umbelled, ovoid, straw-color, some long-peduncled, others nearly sessile; sepals bristle-pointed, longer than the obtuse capsules. Seeds with a conical appendage at base.—Dry fields.

4. **L. spica'ta,** Desvaux. Leaves channelled, narrowly linear; flowers in sessile clusters forming an interrupted spiked panicle, brown; sepals bristle-pointed, scarcely as long as the short-pointed capsule. Seeds merely with a rounded projection at base.—Fields.

Order LVI. **TYPHA'CEÆ.** (Cat-tail Family.)

Marsh or aquatic herbs, with nerved and linear sessile leaves and monœcious flowers on a spadix or in heads, destitute of floral envelopes. Ovary 1-2 celled, with as many styles. Fruit nut-like.

Typha. Flowers in a very long and dense spike terminating the stem; the upper part consisting of stamens only; the lower part of stipitate ovaries, the stipes bearing club-shaped bristles forming copious down.

1. **T. latifo'lia,** L. (Common Cat-tail.) Stout and tall, 4-6 ft. high, the flat, sheathing leaves 3-10 lines broad. Staminate and pistillate parts of the spike 3-6 in. long, contiguous.—In marshes.

Sparga'nium. Flowers collected in separate, dense and spherical, leafy-bracted heads which are scattered along the summit of the stem; the upper sterile, consisting merely of stamens with minute scales; the lower fertile, larger, each surrounded by 3-6 scales, like a calyx.

2. **S. eurycarpum,** Engelm. (Bur-Reed.) Stem stout, 2-4 ft. high; leaves flat on the upper side, keeled on the lower. Fruit-heads 2-6 in. wide, fruit many-angled when mature, with a broad and retuse summit, tipped in the centre.—Borders of ponds.

3. **S. simplex,** Huds. Var. **angustifolium,** Eng. Very slender, leaves floating, long and narrow, ½-2½ lines wide, flat; inflorescence simple. Head not a ½ in. broad.—Sometimes nearly out of water.

Order LVII. **ARA'CEÆ.** (Arum Family.)

Plants with acrid juice, simple or compound, sometimes net-veined leaves and flowers crowded on a spadix which is usually surrounded by a spathe. Floral envelopes none, or of 4-6 sepals. Fruit usually a berry.

Spathe subtending the spadix.

Arisæ'ma. Spathe mostly arched above. Flowers monœcious or dioecious, covering only the base of the spadix. Scape from a solid bulb, the compound leaves net-veined.

1. **A. triphyl'lum,** Torr. (Indian Turnip.) Leaves mostly 2, divided into 3 elliptical-ovate pointed leaflets; spadix mostly dioecious, club-shaped, obtuse, much shorter than the spathe, which is flattened and incurved at the summit. Corm turnip-shaped. Berry scarlet. Very rare.

Calla. Spathe open and spreading, ovate, abruptly pointed, the upper surface white. Spadix oblong, entirely covered with flowers, the upper of stamens only. Berry, red.

2. **C. palustris,** L. (Marsh Calla.) Floral envelopes none, filaments slender; stigma almost sessile. Bogs.

Leaves linear; spadix on the side of the scape.

Acorus. Scape 2-edged, resembling the leaves and bearing the spadix on one edge. Stamens 6.

3. **A. calamus,** L. (Sweet Flag.) Scape much prolonged beyond the spadix.—Swamps.

Order LVIII. LEMNA'CEÆ. (Duckweed Family.)

Minute stemless plants floating free on the water, being merely a frond, producing one or few monœcious flowers from the edge or upper surface, and commonly hanging roots underneath.

Lemna. Frond 1-5 nerved with a single rootlet. Flowers produced from a cleft in the margin, usually 3 together, 2 with one stamen each; the pistillate, of a simple pistil.

L. minor, L. Fronds round to elliptic-obovate 1 2½ lines in diameter, very obscurely 3-nerved.—Stagnant waters.

Order LIX. ALISMA'CEÆ. (Water-Plantain Family.)

Marsh herbs with scape-like stems; sheathing leaves, and perfect or monœcious or dioecious flowers; perianth of 3 herbaceous sepals and as many white deciduous petals: stamens 6 or more, ovaries numerous, becoming achenes in fruit. Leaves radical, petiolate and strongly nerved with transverse veinlets.

Alisma. Flowers perfect, usually 6-androus, carpels flattened, in one whorl. Flowers small, white or pale rose.

1. **A. Plantago,** L. (Water-Plantain.) Leaves long-petioled, ovate, oblong or lanceolate or even linear, mostly rounded or cordate at the base, 3 9 nerved. Panicle compound, 1 2 ft. long, carpels obliquely obovate. Flowers greenish.

Sagittaria. Flowers monœcious or dioecious, stamens numerous, carpels numerous, in more or less globular heads. Leaves arrow-shaped, nerved and with cross-veinlets.

2. **S. variabilis,** Engel. (Arrow-Head.) Scape ½ 4 ft. high, angled with one or more of the lower whorls, fertile; leaves various, almost always sagittate.—In shallow water.

Order LX. NAIADACEÆ. (Pond-Weed Family.)

Marsh or mostly immersed aquatic herbs, with stems jointed and leafy, or in Troglochin, naked and scape-like. Leaves sheathing at base or stipulate, with perianth of 4 or 6 herbaceous segments. Stamens 1, 2, 4 or 6, with extrorse anthers.

Marsh plants with terete bladeless leaves.

Triglochin. Ovaries 3 6 united until maturity. Leaves radical. Flowers bractless, in a spike-like raceme terminating a jointless scape; sepals and petals nearly alike; stamens 3 6, on very short filaments; stigma sessile.

1. **T. maritima,** L. (Arrow-Grass.) Scape 1 3 ft. high and leaves fleshy. Fruit ovate, acutish. Carpels grooved on the back.—Salt marshes.

Flowers perfect, spiked or clustered; anthers 4 or 2 sessile; leaves alternate, dissimilar.

Potamogeton. Sepals 4, [illegible]ded; stamens 4 opposite the sepals, stigma sessile or on a short style. Fruit drupe-like, more or less compressed.

2. **P. natans,** L. (Pondweed.) Stem simple; floating leaves long-petioled, ovate, 21 29 nerved; upper submersed leaves lanceolate, early perishing, lower very slender 3 7 in. long. Spikes 1 2 in. long.

Leaves all submerged and similar, mostly sessile.

3. **P. prælon'gus,** Wulf. Stem white, long and branching. Leaves green, lanceolate, clasping, with a boat-shaped cavity at the extremity. Spikes with long peduncles. —Ponds.

Stipules united with the sheathing base of the leaf.

4. **P. pectina'tus,** L. Stem filiform, repeatedly dichotomous, leaves narrowly linear, attenuate to the apex, 1-nerved, with a few transverse veins; spikes interrupted on long filiform peduncles; fruit obliquely broad obovate, compressed, bluntly keeled.

CRYPTOGAMOUS OR FLOWERLESS PLANTS.

Plants destitute of flowers with stamens and pistils, producing instead of seeds minute bodies called spores, in which there is no embryo.

Order LXI. FI'LICES. Fern Family.

Leafy plants with the leaves or fronds usually raised on a stalk called the stipe, rising from a rootstock, rolled up or circinate in the bud and bearing on the under surface or back or along the margin small reticulated sporangia which split open and discharge the numerous minute spores. Sporangia collected in dots, lines or clusters called sori, sometimes covered by a membrane known as the indusium.

Polypo'dium. Sori round, in one or more rows, on each side of the midrib, or of segments of the frond; no indusium.

1. **P. vulga're,** L. (Common Polypody.) Frond evergreen, oblong, smooth both sides, 4-10 in. high, simple, pinnatifid, veins once or twice forked; fruit-dots large, midway between the midrib and the margin. —Rare. Found only at Dunk River.

Pte'ris. Sporangia in a continuous slender line, occupying the margin of the fertile frond and covered by its reflexed edge which forms an indusium. Fronds 1-3 pinnate.

2. **P. aquili'na,** L. (Common Brake.) Frond dull green, ternate at the summit of an erect stalk or stipe; the branches twice pinnate; pinnules oblong-lanceolate, the upper undivided;

the lower more or less pinnatifid, with oblong obtuse lobes, margined all round with the indusium.

Var. **lanugino'sa.** Divisions of the frond bipinnate, thin and membranous, not hard, teeth rounded; under surface with long scattered wool-like hairs.—One specimen collected at Rustico.

Woodward'ia. Sori oblong or linear, forming a chain-like row each side of the midrib or central vein. Veins reticulated. Indusium opening on the side next the midrib.

3. **W. Virgi'nica,** Smith. (CHAIN FERN.) Fronds 2-3 ft. high, pinnate with numerous lanceolate pinnatifid pinnæ. Segments oblong; fruit-dots confluent when ripe.—Swamp at Memramcook.

Asplenium. Sori more or less elongated, on the upper side of vein [illegible] oblique to the midrib, attached on one side to veinlet, free on the other side. Veins free.

4. **A. thelypteroides,** Michx. (ANGLE-FRUITED LADY FERN.) Fronds 2-3 ft. high, pinnate; pinnæ deeply pinnatifid, linear-lanceolate 3-5 ft. long, the lobes oblong, obtuse, minutely toothed, each bearing 3-6 pairs of [illegible] fruit-dots, some of them double.—Not rare.

5. **A. filix-fœmina,** Bernh. ([illegible] FERN.) Fronds 1-3 ft. high; ovate-oblong [illegible], twice pinnate; pinnæ lanceolate, numerous [illegible] and doubly serrate or elongated and pinnatifid; fruit-dots short, curved, at length confluent. Common.

Phegopteris. Fruit-dots small, round, with [illegible] indusium, and borne on the back of the veins below the apex. Veins free.

6. **P. polypodioi'des,** Fée. (BEECH FERN.) Fronds triangular, hairy on the veins; pinnæ linear-lanceolate, the lowest pair deflexed and standing forward. Fruit-dots near the margins.

7. **P. Dryo'pteris,** Fée. (OAK FERN.) Fronds smooth, broadly triangular, 4-6 in. wide, the three primary divisions widely spreading, 1-2 pinnate; segments oblong, obtuse, entire or toothed. Fruit-dots near the margin.—In woods.

Aspidium. Fruit-dots round, on the back, rarely at the apex of the veins. Indusium covering the sporangia, orbicular and peltate at the centre, or round-reniform and fixed by the centre or the sinus, opening around the margin.

8. **A. thelypteris,** Swartz. (Marsh Shield Fern.) Fronds pinnate, lanceolate in outline; pinnæ linear-lanceolate, deeply pinnatifid, the lowest pair scarcely smaller, lobes oblong, entire, or appearing acute when in fruit from the strongly revolute margins; fruit-dots near the middle of the forking veins. Indusium minute. Stipe or stalk usually longer than the frond.—Swamps.

9. **A. Noveboracense,** Swartz. (New York S. F.) Fronds pinnate, lanceolate in outline, tapering both ways from the middle, pinnæ lanceolate, the lowest 2 or more pairs deflexed; veins simple; fruit-dots separate, near the margin. Indusium minute.—Swamps and moist thickets.

10. **A. Boottii,** Tuckerman. (Dr. Boott's Fern, or Wood Shield Fern). Scales of the stipe pale brown; fronds 1-2½ in. long, elongated lanceolate in outline, narrowed at the base; lowest pinnæ triangular-ovate, the upper longer and narrower; pinnules oblong-ovate, serrate. Indusium minutely glandular. —Common.

11. **A. cristatum,** Swartz. (Crested Shield Fern.) Frond linear-oblong or lanceolate in outline, 1-2 ft. long; pinnæ short, triangular-oblong from a somewhat cordate base, acute, deeply pinnatifid. Sori as near the midrib as the margin, large; indusium orbicular.—Swamps.

12. **A. acrostichoides,** Swartz. (Christmas Fern.) Frond simply pinnate, lanceolate 1-2½ ft. high, pale green, stipe chaffy; pinnæ linear-lanceolate, half halberd-shaped at the base; serrulate with appressed bristly teeth; the fertile pinnæ contracted and smaller, bearing contiguous fruit dots near the midrib. — Abundant a few years ago at Rollo Bay.

Onoclea. Sporangia borne on elevated receptacles forming roundish sori imperfectly covered by very delicate hood-shaped indusia attached to the base of the receptacles. Fertile fronds erect,

with contracted pod-like or berry-like divisions concealing the sporangia. Sterile frond not contracted.

13. **O. sensibilis,** L. (SENSITIVE FERN.) Sterile fronds, long stalked, 2 15 in. long, triangular-ovate, pinnatifid into a few oblong-lanceolate segments; veins reticulated with fine meshes; fertile fronds contracted, closely bipinnate, the pinnules rolled up into berry-like bodies.—Moist meadows and thickets.

14. **O. Struthiopteris,** Hoffm. (OSTRICH FERN.) Fronds tall, several feet long, growing in tufts; sterile ones broadly lanceolate, narrowed towards the base, pinnate with many linear-lanceolate, pinnatifid pinnæ; veins free, veinlets simple; fertile frond shorter, pinnate with pod-like or somewhat necklace-shaped pinnæ.—Rare. Some specimens have been found on the Warren farm.

Dicksonia. Fruit-dots small, globular, marginal, each placed on the apex of a free vein or fork; the sporangia enclosed in a membranaceous cup-shaped indusium on the outer side adherent to a reflexed toothlet of the frond.

15. **D. pilosiuscula,** Willd. (HAY FERN.) Fronds minutely glandular and hairy 2 3 ft. high, ovate-lanceolate and acuminate in outline, pale green, thin, mostly bipinnate. Sori minute, each on a recurved toothlet, usually one on the upper margin of each lobe. Sweet-scented in drying. On borders of fields and shady places; very common.

Osmunda. Fertile fronds or fertile portions of the frond very much contracted and bearing on the margins of the narrow divisions short pedicelled and naked sporangia; these are globular, reticulated and large, opening by a longitudinal cleft into two valves and bearing near the apex the rudiment of a transverse ring.

16. **O. regalis,** L. (FLOWERING FERN. ROYAL FERN.) Very smooth, pale green, 2 5 ft. high; bipinnate; sterile pinnules 13 25, varying from oblong-oval to lance-oblong, finely serrulate, especially towards the apex, entire towards the rounded oblique and truncate base. The fertile pinnules panicled at the summit of the frond. Rare.

17. **O. Claytoniana,** L. (CLAYTON'S FERN.) Clothed with loose wool when young, soon smooth; fertile fronds taller

than the sterile, 2-4 ft. high, pinnæ oblong-lanceolate with oblong obtuse divisions; some of the middle pinnæ, 2-5 pairs, fertile, these entirely pinnate. Sporangia greenish, turning brown.—Low grounds.

18. **O. cinnamomea,** L. (Cinnamon Fern.) Clothed with rusty wool when young, sterile fronds tallest, 3 ft. or more high, smooth when full grown; fertile fronds separate, contracted, twice pinnate, covered with the cinnamon-colored sporangia.—Swamps and low copses.

Order LXII. **OPHIOGLOSS'ACEÆ.** (Adder's Tongue Family.)

Leafy and often somewhat fleshy plants; the leaves or fronds simple or branched, often fern-like in appearance, erect in vernation, developed from underground buds formed either inside the base of the old stalk or by the side of it, and bearing, in special spikes or panicles, rather large bivalvular sporangia.

A small order, separated from the true ferns on account of the different nature of the sporangia, the erect vernation, etc.

Botry'chium. Rootstock very short, erect, with clustered fleshy roots; the base of the naked stalk containing the bud for the next year's frond; frond with fertile and sterile segments. The globular sporangia are sessile and open transversely into two valves.

1. **B. terna'tum,** Swartz. (Leathery Moonwort.) Plant fleshy, 4-16 in. high, slightly hairy. Sterile segment long petioled from near the base of the plant; broadly triangular, ternate and variously decompound with stalked divisions; ultimate segments varying from roundish-reniform and almost entire to ovate-lanceolate and doubly incised; fertile segment erect, 2-4 pinnate.

2. **B. Virginia'num,** Swartz. (Virginia Moonwort.) Fronds tall and ample; sterile segment sessile above the middle of the plant, broadly triangular, thin and membranaceous, ternate; the short-stalked primary divisions once or twice pinnate, and then once or twice pinnatifid, the oblong lobes cut-toothed towards the apex; veins forking from a midvein; fertile part 2-3 pinnate.

GLOSSARY OF COMMON BOTANICAL TERMS.

A.

Abortive, defective or barren.

Acaulescent, stemless or apparently so.

Achene, a small, dry, 1-seeded, indehiscent fruit.

Achlamydeous, without calyx and corolla.

Acuminate, tapering at the apex.

Acute, terminating with a well-defined acute angle.

Adnate, grown fast to.

Alternate, not opposite.

Angiospermous, with seeds enclosed in an ovary.

Annual, lasting one season.

Anther, the pollen-bearing organ of the flower.

Apetalous, without petals.

Appressed, lying close and flat.

Aquatic, growing in water.

Ascending, growing up obliquely or slanting.

Auricle, an ear-like appendage.

Awl-shaped, narrowed up to a sharp point.

Awn, a bristle-shaped appendage.

Axil, the angle between the leaf and stem.

Axillar, growing in the axil.

Axis, the central line of a plant or organ.

B.

Baccate, berry-like.

Barbed, with rigid sharp points, often reflexed.

Beak, a distinct tip or point.

Bearded, with long or stiff hairs.

Berry, a fruit which is pulpy with the seeds embedded in the pulp.

Bi-, or Bis, a prefix meaning two or twice.

Biennial, lasting two years or seasons.

Bifid, two cleft.

Bilabiate, two-lipped.

Bladdery, thin and inflated.

Blade, the expanded portion of a leaf.

Bract, a leaf more or less modified just beneath a flower or flower-cluster.

Bracteol, a secondary bract, or one on the pedicel of a flower.

Bristle, a stiff hair.

Bud, an undeveloped branch or flower.

Bulb, an underground leaf-bud with fleshy scales or coats.

Bulblet, a small bulb, one especially borne in the axil of a leaf.

Bulbous, like a bulb.

C.

Calyculate, having bracts around the calyx.

Calyx, the outer whorl of flower-leaves.

Campanulate, bell shaped, cup-shaped with a broad base.

Capitate, like a head, collected into a dense cluster.

Capsule, a dry, dehiscent fruit.

Cartilaginous, like cartilage, firm and tough.

Caryopsis, a grain or fruit like that of grass.

Catkin, a spike-like cluster as that of willows.

Caudine, belonging to the stem.

Cell, one of the minute vesicles of which plants are formed. Any structure containing a cavity.

Cellular tissue is composed of short, transparent thin-walled cells.

Cespitose, growing in tufts.

Chaff, a small thin scale or bract.

Chaffy, resembling chaff.

Channelled, deeply grooved lengthwise.

Chlorophyll, the green grains in the cells of plants.

Ciliate, with small hairs on the margin.

Cinereous, ash-colog.

Circinate, coiled from the top downward, as the young frond of a fern.

Clavate, club-shaped, thickened upward.

Cleft, cut to about the middle.

Climbing, ascending by means of tendrils.

Cluster, a group of closely associated flowers.

Cohesion, the union of similar parts.

Coma, the tuft of hairs on a seed.

Compressed, flattened.

Compound, composed of two or more similar parts united. Compound leaf, one divided into separate leaflets.

Compressed, flattened laterally

Coniferous, cone-bearing.

Connate, grown together.

Connective, the membrane joining anther-cells.

Convolute, rolled inward from one edge.

Cordate, heart-shaped with the point upward.

Coriaceous, leathery in texture.

Corm, a solid bulb.

Corolla, inner set of leaves of the floral envelope.

Corymb, a flat-topped flower cluster, the lower pedicels lengthened and the outer flowers opening first.

Corymbose, like a corymb.

Cotyledons, the seed-leaves.

Creeping, trailing on the ground.

Crenate, with rounded teeth.

Culm, the hollow stem of a grass.

Cuneate, wedge-shaped.

Cuspidate, tipped with a sharp and rigid point.

Cyme, a flat-topped flower-cluster, the central flowers blooming first.

Cymose, like a cyme.

D.

Deciduous, not persistent, falling early.

Decompound, more than twice compound.

Decumbent, lower part reclining, upper ascending.

Decurrent, having the base of the leaf extending down the sides of the stem.

Deflexed, turned downward.

Dehiscent, splitting open.

Dentate, toothed, with the teeth pointing outward.

Di, twice or two.

Diadelphous, with the filaments of the stamens in two sets.

Diandrous, having two stamens.

Dicotyledonous, having two cotyledons.

Didynamous, having two long and two short stamens.

Diffuse, spreading.

Digitate, compound, the members arising from the same point.

Dioecious, with staminate and pistillate flowers on separate plants.

Discoid, the heads having no ray flowers.

Disk, the central part of the head of a composite flower.

Dissected, cut up into small divisions.

Distinct, not united.

Divided, lobed to the base.

Dorsal, relating to the back of an organ.

Drupe, a fleshy fruit with a stone enclosing the seed.

E.

Elliptical, in the form of an ellipse.

Emarginate, notched at the apex.

Embryo, the undeveloped plant in the seed.

Endogenous, having the wood of the stem in scattered bundles in the cellular tissue.

Entire, without indentations on the margin.

Epigynous, growing on the ovary.

Epiphyte, a plant which grows upon another, but derives its nourishment from the air.

Equitant, applied to leaves which enfold each other as in the Iris.

Erect, upright.

Exogenous, applied to stems with the wood in rings.

F.

Fertile, applied to flowers having pistils.

Fibrous, thread-like.

Filament, the stalk of the stamen.

Filiform, thread-shaped.

Follicle, a dehiscent fruit splitting down one side.

Free, not growing fast to another organ.

Frond, the leaf of a fern.

Fruit, the ripened ovary.

Fusiform, spindle-shaped.

G.

Gamopetalous, having the petals united.

Glabrate, becoming smooth.

Glabrous, smooth.

Glandular, bearing glands.

Glaucous, whitened with a bloom.

Gymnospermous, having seeds which are not enclosed in an ovary.

Gynandrous, with the stamens on the style.

H.

Halberd-shaped, with lobes at the base spreading.

Hastate, halberd-shaped.

Head, a dense cluster of flowers sessile on the enlarged end of a peduncle.

Heart-shaped, deeply indented at the base.

Herb, a plant with little wood in its stem.

Herbaceous, like an herb.

Hirsute, pubescent with hairs.

Hispid, with stiff bristly hairs.

Hoary, grayish white with fine hairs.

Hooded, shaped like a hood.

Hypogynous, on the receptacle and free from the ovary.

I.

Imbricate, overlapping as the bracts of the involucre.

Immersed, entirely under water.

Incised, sharply cut.

Indehiscent, not splitting open.

Inflorescence, the arrangement of the flowers.

Involucel, a secondary involucre.

Involucre, a circle of bracts below a flower or flower cluster.

Involute, rolled inwards.

Irregular, the parts differing in size or shape.

K.

Kidney-shaped, of a leaf having large rounded lobes at the base.

L.

Labiate, having two lips.

Lanceolate, narrow and tapering from the base to the apex.

Lateral, on the side.

Leaflet, one of the divisions of a compound leaf.

Legume, a dehiscent fruit opening by two seams.

Ligulate, strap-shaped.

Linear, long and narrow.

Lobe, a segment or division of an organ.

M.

Midrib, the central vein of a leaf.

Monadelphous, with the filaments united.

Monocotyledonous, having one cotyledon in the embryo.

Monœcious, the staminate and pistillate flowers on different parts of the same plant.

Mucronate, tipped with a minute sharp point.

N.

Naked, without a covering of chaff, hairs, or without calyx and corolla.

Nerve, a longitudinal line on calyx or leaf.

Node, where the leaf arises from the stem.

Nut, an indehiscent fruit, of one seed, with a hard shell.

Nutlet, a little nut.

O.

Obcompressed, flattened back and front.

Obcordate, indented at the apex.

Oblanceolate, narrow and tapering towards the base.

Oblique, unequal-sided, slanting.

Oblong, longer than broad, with sides nearly parallel.

Obovate, inversely ovate.

Obtuse, blunt or rounded.

Opaque, dull; not smooth and shining.

Orbicular, circular.

Oval, almost elliptical.

Ovary, the lower part of the pistil.

Ovate, egg-shaped with the large end down.

P.

Palate, a projection of the lower lip of a bilabiate corolla closing the throat.

Palmate, with veins or leaflets radiating from the end of the petiole.

Panicle, an irregularly compound flower-cluster like a raceme.

Papilionaceous, having a standard, wings and keel, as in leguminous flowers.

Pappus, the tuft of hairs or bristles at the summit of the achene in Compositæ.

Parasitic, living upon other living plants.

Parietal, on the walls of the ovary.

Parted, deeply cleft.

Pectinate, with narrow closely set segments.

Pedate, palmately divided, with the lateral segments two-cleft.

Pedicel, a secondary flower stalk.

Peduncle, the stalk of a solitary flower or of a flower-cluster.

Peltate, shield-shaped.

Perennial, lasting more than two years.

Perfect, with stamens and pistils in the same flower.

Perfoliate, with the stem passing through the leaf.

Perianth, the calyx and corolla when both are present, or the floral envelopes, and not easily discriminated.

Pericarp, the ripened ovary.

Perigynous, around the ovary or attached to the perianth.

Persistent, remaining after other parts have fallen away.

Personate, bilabiate with a projection closing the throat.

Petal, a division of the corolla.

Petiole, a leaf-stalk.

Phanerogamous, or **Phænogamous,** having flowers and producing seeds.

Pinna, one of the primary divisions of the frond of a fern.

Pinnate, with veins or leaflets from each side of a midrib or an extension of the petiole.

Pinnatifid, deeply pinnately cleft.

Pinnule, a secondary division of a frond.

Pistil, the seed-bearing organ of a flower.

Pistillate, having pistils but no stamens.

Pitted, marked with small depressions or pits.

Placenta, the projection in the ovary to which the ovules are attached.

Plumose, with fine hairs on each side, like a feather.

Pod, any dry dehiscent fruit.

Pollen, the grains produced in the anther.

Polypetalous, having separate petals.

Pome, a fruit with the adherent fleshy calyx, of which the apple is the type.

Procumbent, lying flat on the ground.

Prostrate, same as procumbent.

Pteridophytes, ferns and their allies.

Pubescent, covered with soft and downy hairs.

Punctate, showing transparent dots when held up to the light.

Pungent, acrid to the taste.

Putamen, the bony part of a stone fruit.

R.

Raceme, a flower-cluster with the flowers pedicelled upon an elongated axis.

Racemose, resembling a raceme.

Radiate, spreading from a centre, with ray flowers.

Radical, arising from the root or base of the stem.

Radicle, the root of the embryo plant.

Rays, the marginal florets as distinct from the disk in the Compositæ.

Receptacle, the expanded end of a peduncle which bears the flower or flowers.

Recurved, curved backward.

Reflexed, bent backward or downward.

Regular, with all the parts of each series of a flower of the same size and shape.

Reniform, kidney-shaped.

Repand, with a somewhat sinuate margin.

Reticulate, like network, net-veined.

Retuse, with a slight notch at the apex.

Revolute, rolled backward.

Rachis, the axis of a frond.

Rhizome, the underground stem, as of a fern.

Rib, one of the main veins of a leaf.

Ringent, gaping, as the open mouth of a labiate flower.

Rootstock, an underground stem.

Rotate, wheel-shaped.

Rugose, wrinkled.

Runcinate, incised, with the teeth pointing backward as the leaf of the Dandelion.

Runner, a slender trailing stem.

S.

Saccate, sac-shaped.

Sagittate, arrow-shaped, the basal lobes pointing downwards.

Salver-shaped, with a border at right angles to the tube.

Samara, winged, like the fruit of the ash.

Scabrous, rough.

Scape, a leafless peduncle rising from the ground or near it.

Scarious, thin, dry, and membranaceous.

Scurfy, with small rusty-looking scales.

Segment, part of a divided leaf.

Sepal, a leaf or division of a calyx.

Serrate, with the teeth pointing upwards.

Sessile, without a stalk.

Setaceous, bristle-like.

Sheathing, inclosing as if by a tube.

Shrub, a woody perennial smaller than a tree.

Silicle, a short and broad silique.

Silique, the peculiar pod of Cruciferæ.

Sinuate, the outline strongly wavy.

Sinus, the cleft between two lobes.

Sorus (pl. Sori), the fruit dot of a fern.

Spadix, a spike with a fleshy axis.

Spathe, a bract enclosing a spadix.

Spatulate, narrowed down from a rounded apex.

Spicate, like a spike.

Spike, an elongated cluster of sessile flowers.

Spindle-shaped, enlarged in the middle.

Spine, a sharp woody outgrowth of the stem.

Sporangium, a spore-case.

Squarrose, having spreading tips.

Stamen, a pollen-bearing organ.

Standard, the upper petal of a papilionaceous flower.

Stellate, star-shaped.

Sterile, not producing seed.

Stigma, the upper end of the pistil.

Stipe, the leaf-stalk of a fern.

Stipules, leaf-like attachments at the base of a leaf.

Stolon, a branch which forms a new plant.

Striate, marked with longitudinal lines.

Strict, rigid and upright.

Strigose, with appressed, sharp, straight, stiff hairs.

Style, the part of a pistil between stigma and ovary.

Stylopodium, an expansion at the base of a style.

Subulate, awl-shaped.

Succulent, juicy.

Sulcate, grooved or furrowed.

Superior, having the ovary free from the calyx.

Suture, a line of dehiscence.

Symmetrical, with sets having the same number of parts each, or a multiple of that number.

T.

Terete, cylindrical.

Terminal, at the apex.

Ternate, in threes.

Tetradynamous, with four long and two short stamens.

Throat, the entrance to the tube of a calyx or corolla.

Thyrse, a compact panicle.

Tomentose, woolly.

Transverse, across.

Trifoliolate, having three leaflets.

Truncate, as if cut off square across the end.

Tuber, the enlarged end of an underground stem.

Tubercle, a small tuber-like body.

Tuberous, having the appearance of a tuber.

Tunicated, having coats one within another.

Twining, winding spirally around a support.

U.

Umbel, a flower-cluster with all the pedicels radiating from the same point.

Umbellet, a secondary umbel.

Undulate, wavy.

Utricle, an indehiscent 1-seeded fruit.

V.

Valvate, opening by valves; meeting by the edges without overlapping.

Valve, one of the pieces into which a capsule splits.

Vein, a thread of fibro-vascular tissue in a leaf, especially such as branches.

Ventral, belonging to the anterior, or inner face of an organ.

Vernation, the arrangement of leaves in a bud.

Versatile, attached near the middle, so as to turn freely.

Vertical, upright.

Verticillate, whorled.

Villous, bearing long, soft hairs.

Viscid, glutinous, sticky.

W.

Whorl, an arrangement of leaves in a circle about the stem.

Wing, any membranous or thin extension bordering an organ.

Woolly, covered with long and matted hairs.

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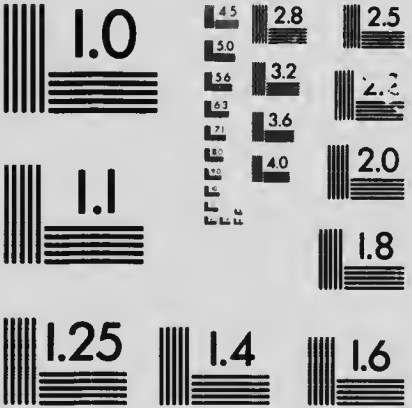

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