SCHOOL BOTANY,

AND

VEGETABLE PHYSIOLOGY;

OR, THE RUDIMENTS OF BOTANICAL SCIENCE.

BY

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A New Edition.

WITH CORRECTIONS, NUMEROUS ADDITIONS, AND MORE THAN FOUR HUNDRED ILLUSTRATIONS

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PREFACE.

This work was originally prepared, in haste, to meet a regulation of the University of London, by which it was required of all students, that, two years previously to proceeding to their first degree, they should be examined, among other subjects, in "The characters and differences of the *principal* natural classes and orders of plants belonging to the Flora of Europe, in the botanical classification of De Candolle."

The obvious purpose of this regulation was to make young men acquainted with the names and properties of the vegetation that surrounds them; so that, after receiving what is called a liberal education, they might not be thrown upon the world, ignorant of the names, at least, of the commonest plants of their own country. In the opinion of the author the measure was calculated to effect a real good, and to supply a wide gap in the common routine of a school, where it is most desirable that some natural history should be introduced, if it be only to relieve the tedium of the less attractive studies to which young persons are necessarily subjected.

But it was also important for the sake of its substantial utility. There may be a difference of opinion as to the advantage of spending much time upon the study of Botany; but there is one opinion only as to the importance of knowing the names of the plants of which man has to make use, or which he is continually meeting with. There is not at the present day a person of any intelligence,

ignorant of such things, who does not regret that some pc
his youth should not have been devoted to this kind of in
ortion of
quiry.

The Dorsetshire gentleman who put himself to co
siderable
trouble and no small expense to carry a sack of Hornbeam s
from
Florence to London, would have been saved the exertion ha
known that the Hornbeam grew in abundance on his own estate, and it may be safely asserted that every one of that celebrated court party which discovered a prodigy in the beautiful tree in Windsor Park, would have been glad if their early education had spared them the mortification of learning from Lord M. that the tree in question was only the Spanish Chesnut.

Whatever the future intentions of a student of Botany may be, it is indispensable that the first step to be taken should be that of gaining an acquaintance with the common plants of his own country. In the absence of that, he cannot make a single move i
advance. He must first master the rudiments of the Science, and master them correctly. This little book has been prepared for
purpose of enabling him to do so. It contains all that it i
sary to know in order to make a fair beginning, and it inch
more; so that if any one should have the patience to mast
whole contents of the volume, he would then be in a posit
carry his inquiries onwards with ease. But it is not really n
sary to become acquainted with all the plants here mentioned.

The reason why so many species are introduced, which are of small importance, is to enable the teacher to obtain at least some part of them to illustrate his teaching. Local circumstances, and especially our uncertain seasons, will always render it difficult to procure everything here mentioned; but no conceivable circumstances can, in this country, offer impediments to the examination of a large part.

In selecting the subjects with which the student is to be made acquainted, those have been generally chosen which are within any man's reach; and to render the acquisition of them more easy, the

vulgar names are added. A very small sum of money will enable every schoolmaster to cultivate the whole in a garden, where they may be constantly at hand.

In framing the technical characters of genera and species, all the more minute distinctions, the detection of which requires the aid of a microscope, have been intentionally disregarded; and attention is more especially called to those which are obvious enough to be observed by any one having a pocket lens.

Which of the European natural orders I regard as the "principal," will be apparent from the prominence given here to certain natural orders beyond others. The teacher is not, however, recommended altogether to omit those which are stated to be comparatively unimportant. The wisest course will be to make the students thoroughly acquainted, in the first instance, with the natural orders which are marked from I. to LXXIII., and then to explain more briefly the differences of those to which no numbers are prefixed.

In conclusion, the teacher is particularly recommended to take care that, in addition to a small penknife, each student is provided with a pocket lens of about a half-inch focus, and a few quires of paper;* the former to assist him in examining, and the latter in drying, the fresh specimens of plants daily brought before him. There is no method so certain as the latter, to accustom young persons to estimate correctly the differences between one plant and another; and, it is presumed, no one will think of teaching Botany, without an ample supply of fresh specimens, which he may distribute among his class, for the purpose of being examined and studied at leisure. Indeed, it is useless to study botany, unless this provision is made for the acquisition of those habits of observation which render natural history so peculiarly useful as a branch of mental training.

* The proper paper for this purpose is manufactured by Messrs. Bentall & Co., of Halstead, and is the best that is known.

When students do not enjoy the advantages of a competent teacher, their best plan will be to put this book into the hands of an intelligent gardener, and to induce him to furnish them weekly with the plants that are named in it. At home they can compare the definitions which they may find with the plants themselves, and this kind of practice is, of all others, the most certain to lead to advantageous results.

University College, London.
March 31, 1845.

The former editions of this little work have been so well received, that the author avails himself of the present re-issue to append a chapter on Vegetable Physiology, in the hope that young persons may be induced to familiarise themselves with at least the rudiments of that important subject. A very small garden may contain illustrations of the more common facts, and any well-informed gardener can supply a teacher or student with whatever may be further necessary to a clear comprehension of the principles laid down.

In the systematical part of the work a few errors have been corrected, several additions have been introduced, and many wood-cuts have been added when the subject appeared to render it desirable.

University College, London.
December, 1853.

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CHAPTER X.

SCHOOL BOTANY.

CHAPTER I.

OF PLANTS IN GENERAL.

A PLANT, under ordinary circumstances, springs from a *seed* (Fig. I. *t*); sends downwards a *root*, upwards a *stem*, and on the stem forms *leaves* and other parts. In its most perfect state it consists of various organs, intended by nature to answer different purposes. These are, 1. The *Root;* 2. The *Stem*, with 3. Its *buds*; 4. The *Leaves;* 5. The *Flowers*; 6. The *Calyx;* 7. The *Corolla*; 8. The *Stamens*; 9. The *Pistil*; 10. The *Fruit*; 11. The *Seed*.

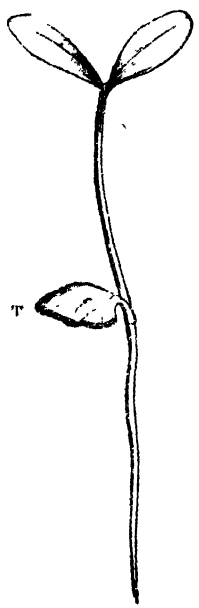


Fig. I.

1. The ROOT is the part which fixes a plant to the ground, or to whatever else it may grow upon. It is divided into irregular branches, which when very small are called *fibres*; and if large and fleshy, as in the Orchis (Fig. II.) are named *tubercles*. It never has any leaves upon its surface, nor scales, (which are imperfect leaves); neither has it buds, except accidentally. It generally descends into the earth or avoids exposure to light.

Its office is to attract from the earth the liquid and gaseous matters which constitute the food of plants.

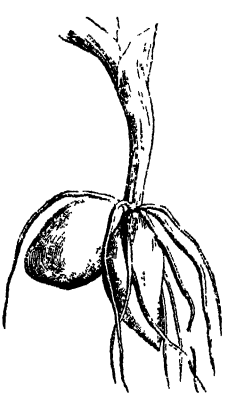


Fig. II.

2. The STEM is the part which grows upwards from the root, and which bears leaves and flowers. Generally it is green, and divided into branches in a regular manner. The branches originate from *buds*, which are also disposed upon the stem with great regularity. Light appears necessary to maintain a stem in a green state, and we consequently find it only produced of such a colour in places exposed to that agent.

But it is the nature of some plants to produce their stems underground, as well as above the surface. In that case, as in the Potato, the subterranean stem is not green; and its leaves, if it has any, are only little scales, (Fig. VI.) Its buds are however, present, and are capable of growing into branches, which rise above the surface of the ground and expose themselves to light, like those of the stem in its ordinary state. The *creeping root* (Fig. IV., Carex arenaria) as it is called, of Couch Grass (Triticum repens) and of Mint (Mentha) is a long, slender, underground stem, and its real roots are the fibres which proceed from it. The *tuber* of the common Potato (Solanum tuberosum, Fig. III.), is a thick, fleshy, underground stem, the *eyes* of which are its buds. What is named the root of a Crocus is a variety of the tuber, called a *corm* (Fig. V. Arum maculatum).

Fig. III.

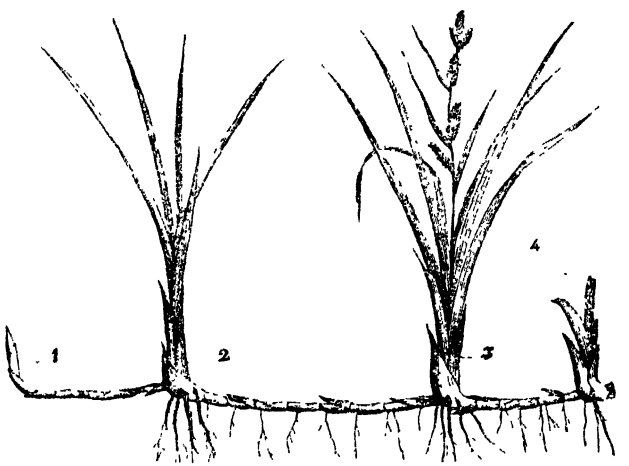


Fig IV.

The manner in which tubers are sometimes formed, and the fact that the parts so called are really portions of stems, is beautifully proved by the following instructive instance recorded in the *Gardeners' Chronicle*, vol. ii. p. 85:—

A Potato plant, such as is represented opposite, had to grow beneath an inverted flower pot in a dark cellar, where, being starved for want of food, it had formed itself into a complete miniature Potato plant, such as would

have grown irregularly under ground had it been surrounded by soil, but which, branching in the air only, and meeting with no resistance, had

Fig. V.

grown with the same regularity as an ordinary plant above the ground. The "set," or old tuber, was shrivelled up, and formed a wrinkled knob, out of which grew many branches and branchlets. Of the latter, some, thickening at the points, became small potatoes; others, having no power of lengthening, swelled close to the parent stem; and all were covered with scales, the rudiments of leaves. At first sight the plant appeared as if it had been unable to form roots; but a minute inspection showed that they were really beginning to form here and there in many places upon the surface of the branches.—The stem, properly so called, has names expressive of particular modifications. When thick and woody, and forming the base of a tree, it is

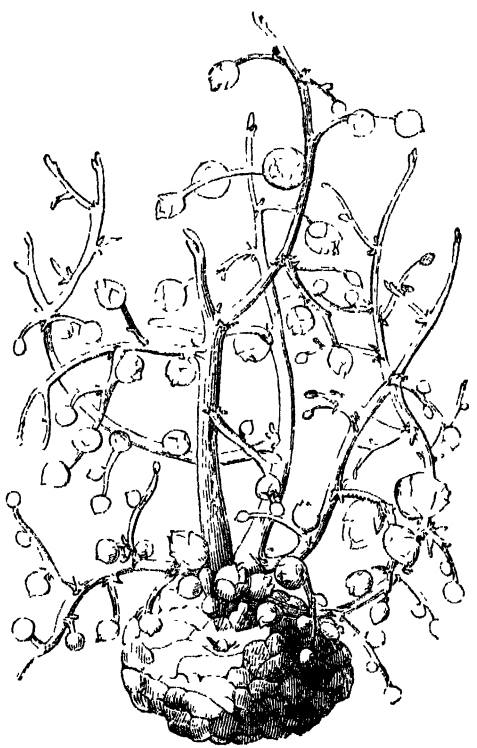


Fig. VI.

and the last *twigs*. When it grows straight and quickly, it is sometimes named a *shoot*. If feeble and prostrate, and rooting into the ground at its joints, it is a *runner* (Fig. VII.), as in the Strawberry (Fragaria). If prostrate and rooting into the ground along its

whole under-surface, it is a *rhizome*, as in the Iris (Fig. VIII). If vigorous, and produced from the base of a trunk or stem underground, it is called a *sucker*, as in the Asparagus. If very short, and producing annually young branches, which live for a season and then perish, as in all herbaceous plants, it is named the *crown of the root*.

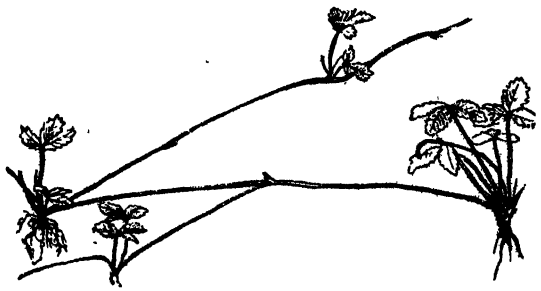


Fig. VII.

Sometimes branches are short, rigid, and sharp-pointed, as in the Whitethorn (Cratægus Oxyacantha) and the Blackthorn (Prunus spinosa); they are then called *spines*.

If a stem is swelled at the part where the leaves grow, and capable of being snapped across, or apparently so, it is called *articulated* or *jointed*, as in Stellaria Holostea, and Geraniums.

The use of the stem is to convey into the leaves the fluid and other food obtained by the roots from the earth, and to carry it back again. Its length, and the distance at which the leaves are arranged upon it, render it well adapted to separating those organs from each other at a distance suitable to ensure their proper exposure to light and air.

Fig. VIII.

projection found at the axil of a leaf; that is to say, within the angle formed by the junction of a leaf to a stem. It is composed of *scales*, which are small leaves, and is the part from which the branch is formed. Sometimes its scales become

fleshy, and the bud drops off the stem without at that time producing a branch, as in some Lilies; it is then called a *bulb*. Very often the bulb is formed underground upon a subterranean portion of the stem, as in the Hyacinth (Fig. IX.): it is then vulgarly supposed to be a root. The real roots are the fibres, which may be seen shooting downwards into water when the Hyacinth is grown in a glass.

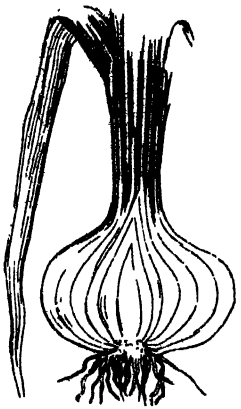


Fig. IX.

The LEAF is an expansion of the stem, and consists of two parts, the *petiole* or *stalk*, and the *lamina* or *blade*. Some leaves have no stalks, and are therefore called *sessile*. The leaf contains *ribs* and *veins*, which branch in different ways. If they are so arranged that they form a kind of network they are said to be *reticulated*, as in the Currant (Ribes rubrum), the Cherry (Fig. XI.), and the Oak (Fig. X.); if they run along side by side, as in Grasses, they are called *parallel* (Fig. VIII.)

Leaves are said to be *simple* when, however much they are divided, they do not separate into distinct pieces; those of the Willow (Fig. XII.), of the Maple (Fig. XXIII.) are all *simple*, although in the latter they are

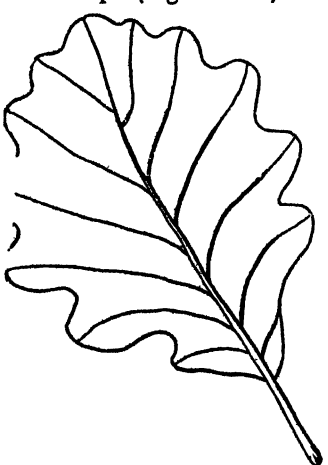


Fig. X.

divided. But if they are cut into a number of distinct pieces, they are called *compound*, as in the Pea (Fig. XVI.) and the Ash tree (Fraxinus excelsior).

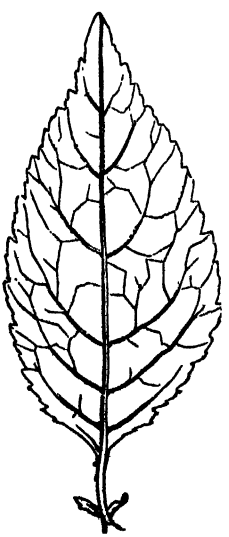


Fig. XI.

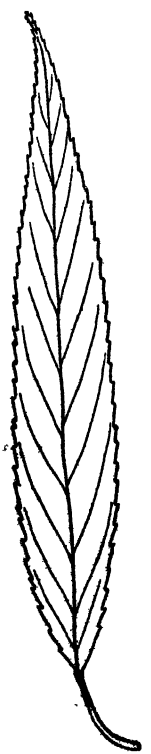


Fig. XII.

If leaves grow in pairs upon the stem, exactly opposite each other on the same level, as in the Phillyrea (Fig. XIII.), they are said to be

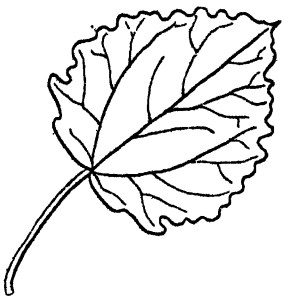


Fig. XIV.

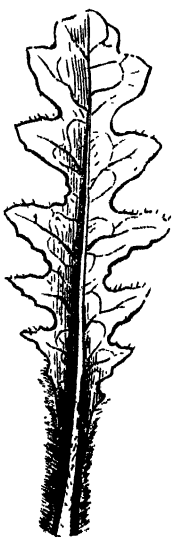


Fig. XV.

Fig. XVI.

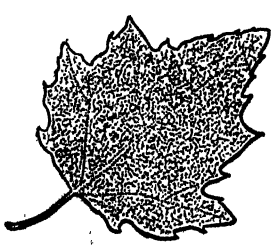


Fig. XVII.

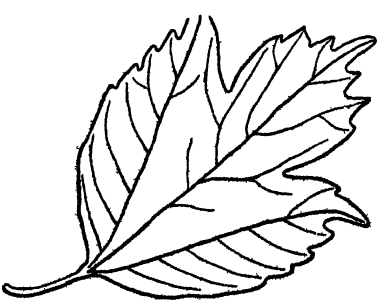


Fig. XVIII.

but if more than two leaves are opposite to each other on the same level,

Fig. XIX.

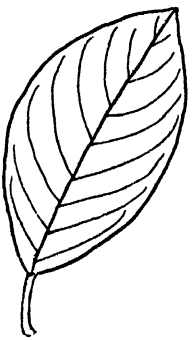


Fig. XX.

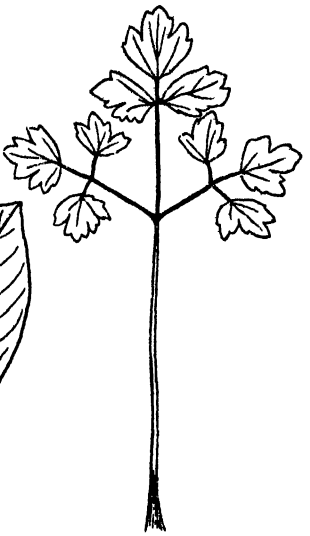


Fig. XXI.

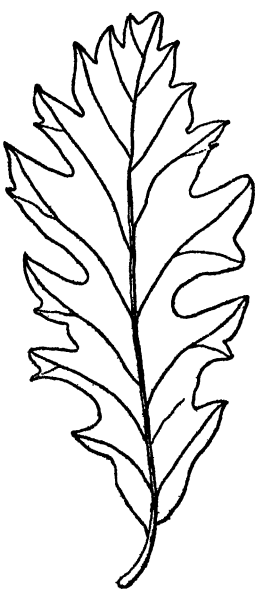


Fig. XXII.

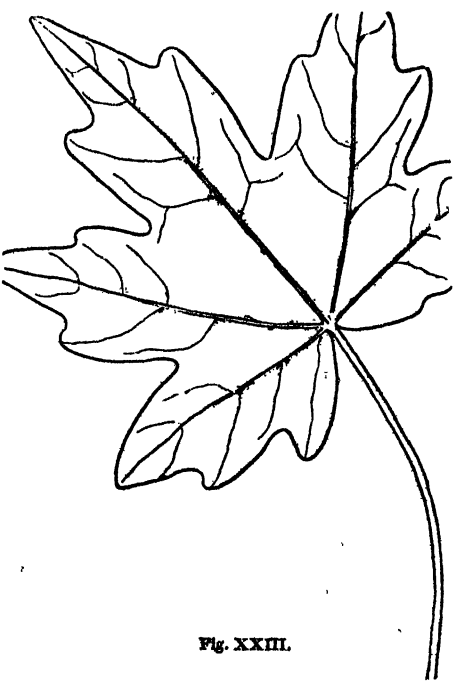


Fig. XXIII.

as in the Goose-grass (Galium cruciatum), they are called *verticillate*; if

they do not grow upon the same level, but one is a little above or below the other, as in the Whitethorn, they are called *alternate*.

The forms of leaves are better explained by examples than descriptions; the following are representations of the most common varieties:—XII., *linear-lanceolate*; XXV., *lanceolate*; XX., *oval*; XXXII., *oblong*; XIV., XXIII., *cordate*; XXIV., *oblong, oblique at the base*; XXXI., *rhomboid, and acuminated*; XXXIII., *sagittate*; X., *sinuated*; XVII., *angular*; XV., XXII., *pinnatifid*; X., *ovate*; XVIII., 3-*lobed*; XXIII., *palmate*; besides which, the terms *pedate* (Hellebore), and *ternate* (Clover), are in common use.

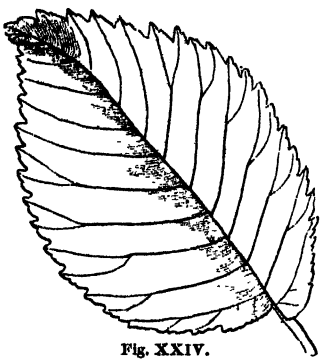


Fig. XXIV.

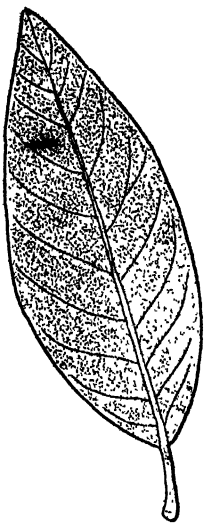


Fig. XXV.

When leaves are cut up into distinct leaflets, they acquire other names.—Suppose that to happen with No. XXIII. you have the *digitate* leaf of the Horse-chestnut; if with No. XXII. or XV., we obtain the *pinnate* leaf of the Pea. (No. XVI.)

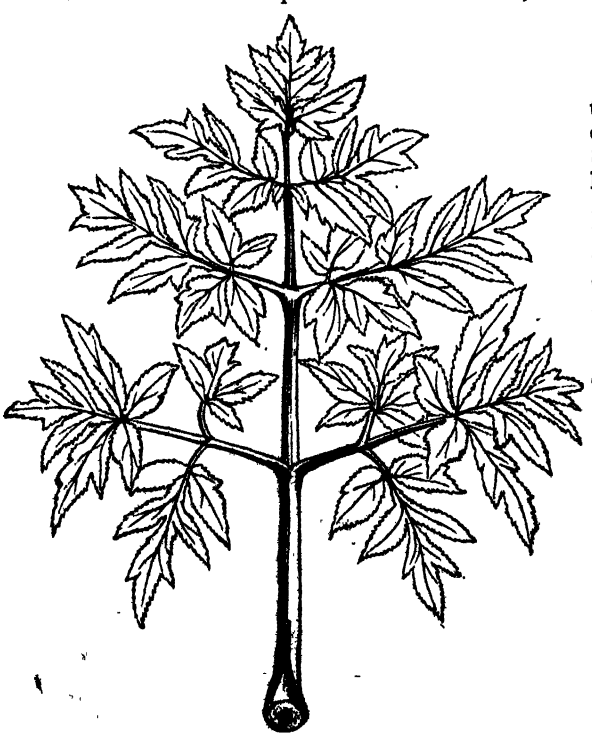


Fig. XXVI.

Some leaves are repeatedly divided upon the same plan as that which determines their primitive form, and then they acquire very different appearances. Variations of such a kind are usually expressed by

prefixing a Latin numeral to the word expressing the simple form; thus from *ternate* the clover, comes XXI. *bi-ternate*, or twice ternate; and from *pinnate*, XXVI. *bi-pinnate*, or twice pinnate, and so on. If the division of leaves is carried much further, they are called *decompound*, or *supradecompound*, as in the hemlock (Conium maculatum).

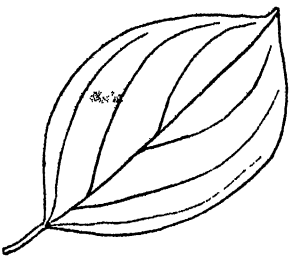


Fig. XXVII.

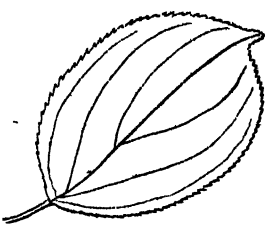


Fig. XXVIII.

Some terms are taken from the manner in which the margins of leaves are toothed. If the toothings are sharp and small, like those of a saw, the leaves are *serrate* (Fig. XXVIII.); if rounded they are *crenate* (Fig. XXIX.); if notched, so as to form segments of small circles, they are *dentate* (Fig. XXXII.). Sometimes the serratures of leaves are themselves serrated; such a leaf is called *biserrate* (Fig. XXX.); and in like manner we have the terms bicrenate and bidentate, or rather duplicato-dentate. When there is no toothing a leaf is called *entire* (Fig. XXVII.).

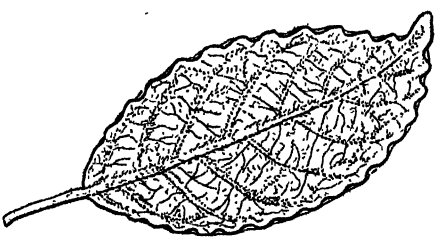


Fig. XXIX.

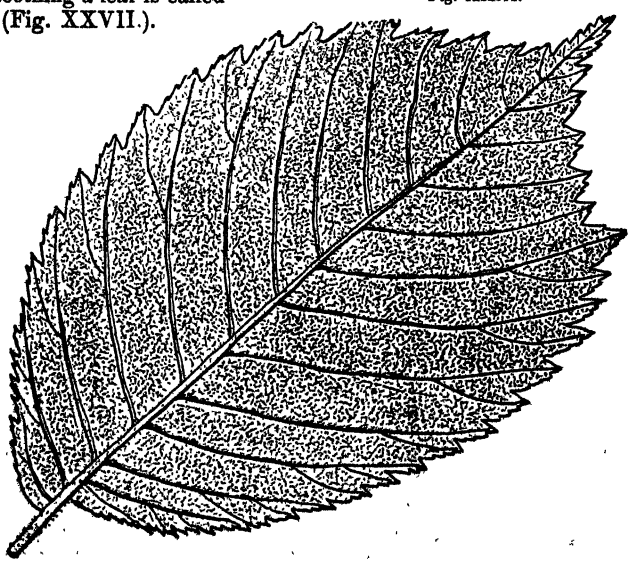


Fig. XXX.

With respect to their point, leaves are *obtuse*, or *acute*, in the ordinary sense of those words; if very blunt they are *retuse* (Fig. XXXII.); if very much tapered to a point, they are *acuminate* (Fig. XXXI.); if with the midrib prolonged a little beyond the blade of the leaf, they are *mucronate* (Fig.

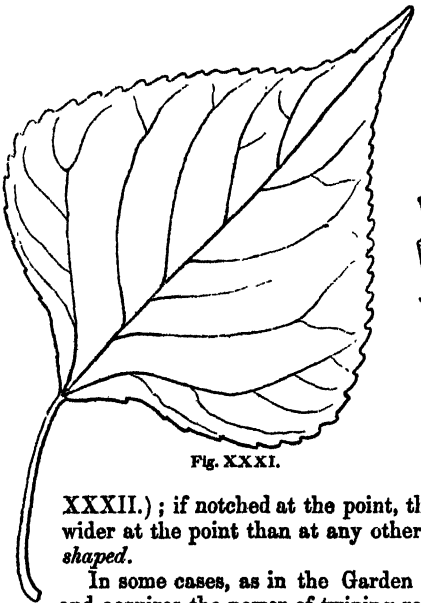


Fig. XXXI.

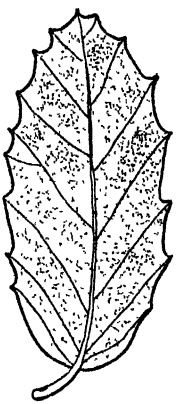


Fig. XXXII

Fig. XXXIII.

XXXII.); if notched at the point, they are *emarginate*; if very much wider at the point than at any other part, they are *cuneate* or *wedge-shaped*.

In some cases, as in the Garden Pea, the midrib is lengthened, and acquires the power of twining round small bodies placed near it; it then has the name of *cirrhus* or *tendril* (Fig. XVI.).

Sometimes leaves acquire the condition of spines, as in the Berberry, (Berberis vulgaris). In that plant the stem forms in the first instance spiny leaves, and afterwards in their axil spring up leaves of the ordinary kind.

Many leaves have, at their base, a pair of scales, one on each side, as the Garden Pea, where they are large and green, (Fig. XVI.), the Mallow, where they are small and withered, or the Pear-tree where they are very long and narrow (Fig. XXXV.); these are called *stipules*. It is generally easy to distinguish them; but in some plants, as Polygonum hydropiper, they form a membranous tube, or *ochrea* (Fig. XXXVI.), surrounding the stem, and then are unlike their usual condition.

The petiole is usually round, or nearly so; but in Grasses and other plants it is thin, and rolled round the stem, in which case it is called a *sheath*, or *vagina*. In such plants there is often a thin membrane called a *ligula*, at the upper end of the sheath.

The use of leaves is to convert into new matter the sap which they obtain from the stem; they also act as organs of respiration, and naturally contain a large quantity of air. They are, therefore, at the same time the lungs and the stomach of a plant.

5. The FLOWER is the part which is formed for bringing about the multiplication of a plant by seed. It consists of various organs arranged in rings, or *whorls*, one within the other. The small leaves, out of whose axils the flowers grow, are called *bracts*. The stalk of the flower is its

peduncle; and if the latter is divided into many smaller stalks, its divisions are called *pedicels.* Thus in the common Foxglove, (Fig. XXXVII.) the

Fig. XXXIV.

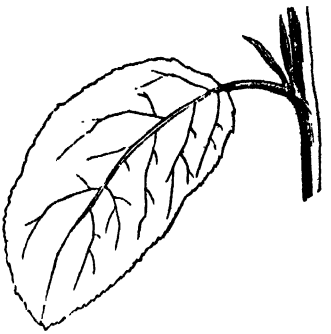


Fig. XXXV.

Fig. XXXVI.

stalk immediately rising from within the leaves is the peduncle; the small stalks, each of which bears a flower, are the pedicels; and the withered scales, out of whose axils the pedicels spring, are the bracts.

Bracts in different states have received different names. When a bract is large, and encloses a great many flowers, as in the Wake Robin (Arum maculatum), it is called a *spathe* (Fig. XXXVIII.); when many bracts are collected in a whorl round several flowers they form an *involucre,* as in the Dandelion (Taraxacum Dens Leonis) and Fool's Parsley (Fig. XXXIX). The word *involucel* is used for an involucre which is secondary to one of a more general kind, as in the common Parsley (Petroselinum sativum), where the involucre is composed of only a few bracts at the base of the general

umbel, while the involucels at the base of the partial umbels consist of many bracts.

The manner in which flowers are arranged is called their *inflorescence*. It is a sort of branching, and has different names, according to the manner

Fig. XXXVII.

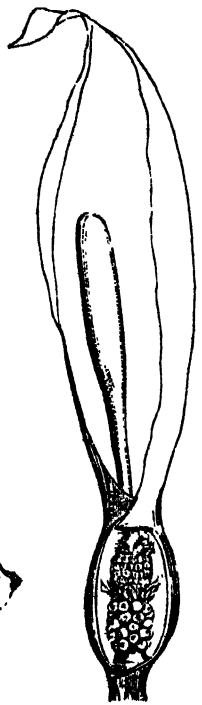


Fig. XXXVIII.

Fig. XXXIX.

in which the branches are arranged. The principal kinds are these :—1. The *capitulum*, or *flowerhead*, when all the flowers are sessile upon a broad plate called a *receptacle*, as in the Daisy (Bellis perennis). 2. The *umbel*, when the pedicels all radiate from one point, as in the Cherry (Fig. XL.) ; this is called compound, when each ray of the umbel is itself umbellate, as in the Fool's Parsley (Æthusa Cynapium, Fig. XXXIX). The *spike*, when the flowers are sessile along a common peduncle, or axis, as in Ribgrass (Plantago lanceolata). 4. The *raceme*, when the flowers are all stalked along a common axis, as in the Currant. 5. The *corymb*, when the flowers of a raceme are all on the same level, as in Candy Tuft (Iberis). 6. The *panicle*, when the pedicels of a raceme are themselves branches, as in the Fiorin Grass (Agrostis stolonifera). 7. The *cyme*, when a panicle is corymbose and irregularly contracted, as in the Elder-tree (Sambucus nigra, Fig. XLI.) A *spadix* is the inflorescence inclosed in a spathe (Fig. XXXVIII. ;) an *amentum*, or *catkin*, is a

Fig. XL.

spike consisting of imperfect flowers, as in the Willow (Salix) and Hazel (Fig. XLII.).

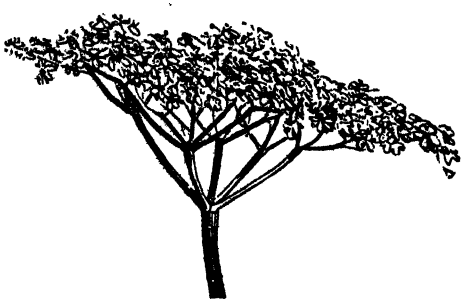


Fig. XLI.

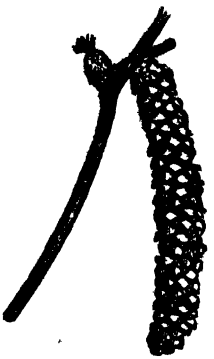


Fig. XLII.

A flower, if complete in all its parts (Fig. XLIII.), consists of a *calyx*, a *corolla*, *stamens* and a *pistil*, with the addition in some cases of a disc.

6. The CALYX is a whorl of leaves called *sepals*, which are either separated from each other, or grow together by their edges into a cup. It is always on the outside of the flower, and is generally green; but sometimes it is of some other colour. Generally, the calyx grows free from the pistil, so as to leave the sides of the latter naked, as in the Borage (Fig. XLIV.), the Hyacinth, the Geranium, &c.; and in that case it is said to be *inferior* or *free*. But in many cases the calyx is united to the surface of the pistil, as in Parsley, the Currant, the Myrtle, (Fig. XLV.) &c., and is then called *superior* or *adherent*.

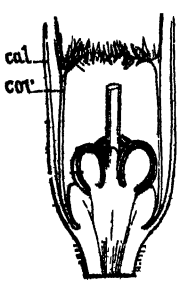


Fig. XLIII.

Fig. XLIV.

Certain names are employed to express differences in the form of the calyx (and of all such parts); the principal of which are the following:—1, *tubular*, when it forms a kind of tube or sheath (Figs. XLVI., XLVII., XLIX.); 2, *prismatical*, when, being tubular, it is also regularly angular; 3, *ventricose*, when it is contracted at the apex, so as to look as if inflated; 4, *cup-shaped*, when it resembles a drinking vessel of that name; 6, *rotate* (Fig. XLVIII.) when it has a short tube, and a spreading border, the former representing the nave, and the latter the spokes of a (rota, or) wheel; 5, *campanulate*, when it has the form of a (campana or) bell; 7, *salver-shaped* (hypocrateriform), when its tube is long and cylindrical, and its border short and

Fig. XLV.

8, *funnel-shaped* (Fig. XLVI., XLIX.), (infundibuliform), if it resembles an inverted cone; 9, *labiate*, if its parts are so united as to form two distinct lips, (Fig. LI.)

Fig. XLVI.

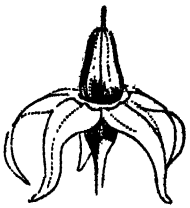


Fig. XLVIII.

Fig. XLIX.

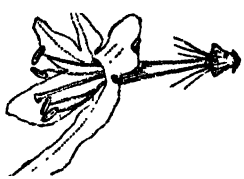


Fig. XLVII.

It is also said to be *regular* (Fig. XLVI.) if its parts are all of equal size, and *irregular* if they are of different sizes (Fig. L.). The manner in which the divisions of the calyx are fitted together before it expands is called its *æstivation*, and is in most cases one of two kinds—*valvate*, when the sepals join exactly by their edges, as in the Mallow (Malva sylvestris); or *imbricate*, when the sepals overlie each other at the edges, as in the Dog-rose (Rosa canina).

The use of the calyx is to assist in the protection of the interior, often more delicate, parts of the flower.

Fig L.

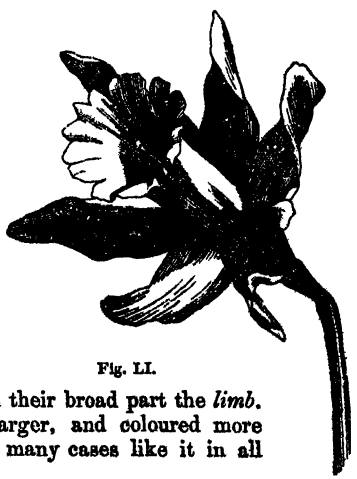


Fig. LI.

7. The COROLLA is the whorl of leaves next the calyx in the inside; its parts are called *petals*, their narrow stalk, if they have one, the *unguis*, and their broad part the *limb*. This organ is usually more delicate, larger, and coloured more gaily than the calyx, but it is also in many cases like it in all these respects.

If the petals are all distinct, a corolla is said to be *polypetalous*; if they are united into a tube, it is called *monopetalous* or *gamopetalous*. Otherwise, the terms used in speaking of the corolla are much the same as those applied to the calyx.

It is usually the corolla which gives its great beauty to a flower, and it is supposed that its office is in part to attract insects, which by their motions when robbing it of its honey, assist in conveying the pollen to the stigma.

Sometimes there is within, or upon, the corolla, a cup, as in the Daffodil (Fig. LI.), or a ring of scales, as in the Passion-flower; this is the *Coronet*. It is also called *Nectary*, as are any Glands or small secreting bodies.

8. The STAMEN (Fig. LII.), is one of the parts which stand next the corolla in the inside. It consists of a stalk or *filament*, and a head or *anther*, containing a powder named *pollen*. The filament may be absent, in which case the anther is *sessile*.

Fig. LII.

The filaments are usually distinct from each other, as in the Strawberry; sometimes they grow together into a tube, as in the Mallow, when they are *monadelphous*. Sometimes they grow together in two parcels, as in the common Pea, where nine are collected into one parcel, and one stamen stands by itself; in this case they are *diadelphous* (Fig. LIII.); more rarely they combine into more than two parcels, as in various kinds of

Fig. LIII.

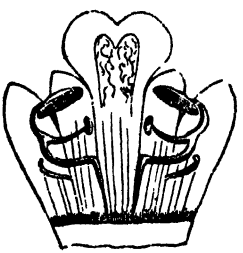


Fig. LIV

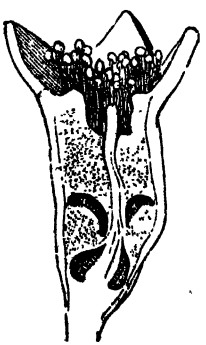


Fig. LVI.

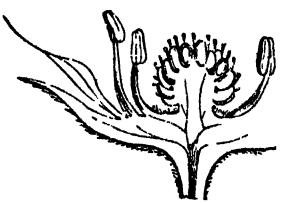


Fig. LVII.

Fig. LVIII.

Hypericum, and are *polyadelphous*. If the filaments grow from immediately below the pistil, so that they remain behind when the calyx is pulled off, they are called *hypogynous* (Fig. LV.); but if they grow upon the sides of the calyx they are *perigynous* (Fig. LVII.); if upon the sides of the corolla, they are *epipetalous* (Fig. LIV.); and if upon the summit of the ovary, they are *epigynous* (Fig. LVI.)

The anthers usually consist of two lobes, united by a part called the *connective;* they are in most cases distinct from each other, even though the filaments are combined; but sometimes grow together, when they are called *syngenesious*, as in the Sow-thistle (Sonchus oleraceus) and its allies (Fig. LVIII.). In the greater part of plants they open by longitudinal fissures; but sometimes, as in the Heath (Calluna vulgaris), by pores at their points. They generally shed their pollen by openings along that side which faces the pistil, and are said to be *turned inwards;* now and then they shed it by openings along that side which faces the corolla, as in the Iris, and in that case are described as being *turned outwards*.

The office of the stamens is to fertilise the ovules, by conveying to the stigma the pollen, without which this purpose cannot be accomplished.

It not unfrequently occurs that between the stamens and the pistil there is a cup, or ring, or a waxy lining of the intervening part; to such an additional organ the name of *disc* is given (Fig. LV., XLIII. *dis.*)

9. The PISTIL (Fig. LX.) occupies the centre of the flower, and is composed of one or more bodies named *carpels*, which are either distinct from each other or combined into one organ. Each carpel consists of a hollow case, or *ovary*, extended at the point into a *style* or *styles*, which are tipped with a viscid secreting space called the *stigma*.

The interior of the ovary is called the *cell* (loculus). If the pistil contains but one cell in its ovary it is *unilocular* (Fig. LIX.); but if there are more cells than one it is either *bilocular*, *trilocular* (Fig. LXII.), *multilocular*, or otherwise, and the partitions that divide the cells from each other are called *dissepiments*. If the cells of the ovary are all consolidated into

Fig. LIX.

Fig. LX.

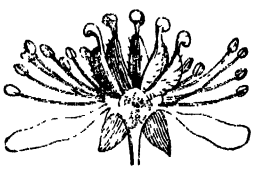


Fig. LXI.

Fig. LXII.

one body as in the Violet, the pistil is said to be *syncarpous* (Fig. LX.); if they are distinct from each other, as in the Spiræa, it is called *apocarpous* (Fig. LXI.).

In the inside of the ovary is a space called the *placenta*, on which the young seeds, or *ovules*, originate. If this placenta grows from the sides of the ovary, as in the Poppy (or Orchis, Fig. LXIII.) it is *parietal*; if it grows in the middle of the ovary, without adhering to its sides, as in the wild Lychnis (Lychnis dioica) and the Arum (Fig. LXIV.), it is called *free central*; if it grows from a centre which is connected with the sides of the ovary by dissepiments, as in the Iris, it is *axile* (Fig. LXII.)

Fig. LXIII.

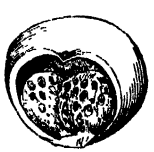


Fig. LXIV.

When the ovary is distinct from the calyx it is called *free* or *superior* (Fig. LXI.); if it grows to the sides of the calyx, *adherent* or *inferior* (Fig. LXV.)

The part of the inside of the ovary from which the ovules grow, their number, and their direction, are different in different plants. In some cases they grow from the upper part of the cavity, and are *pendulous*, as in the Dandelion; in others they grow from the bottom of the cavity, as in the Scabious, when they are *erect*. In the plants last-named they are solitary, only one growing in the cavity of the ovary: in such species as the Poppy they are extremely numerous; and there are all intermediate numbers.

Fig. LXV.

The ovary is intended as a covering and protection

for the young ovules which, after being fertilised, become seeds. The stigma is the body on which the pollen, or fertilising matter, falls; and the style conducts a part of that matter to the ovules.

In modern Botanical books it has become usual to give what are called DIAGRAMS of a flower. The object of this contrivance is to show the position which one part of the flower bears to any other part. It is effected by

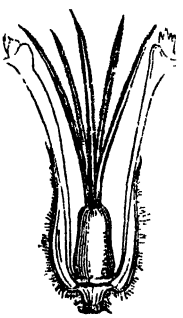


Fig. LXVI.

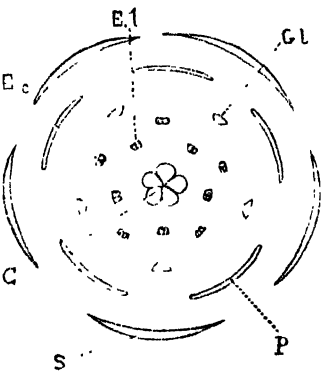


Fig. LXVIII.

arranging, in a series of concentric circles, lines which represent the different parts, in the order in which they stand respectively; the pistil being the centre. This is shown in the two following instances. In Fig. LXVIII. we have a flower with all the parts in fives; that is to say, there are 5 *S*, or sepals; 5 *P*, or petals; 5 *Gl*, or glands for the disk; twice 5 *E*, or stamens; and 5 *C*, or carpels, forming an ovary. In Fig. LXIX. the parts are only placed partially in fives; and one-fifth of the pistil is deficient; that is to say, there are 5 *S*, or sepals; 5 *P*, or petals; and 5 *E*, or stamens; but there are only 4 *C*, or carpels; and there is no disk. Such contrivances are very useful for the purpose of representing the abstract condition of a flower without reference to form, or colour, or texture; and also for comparing one kind of structure with another.

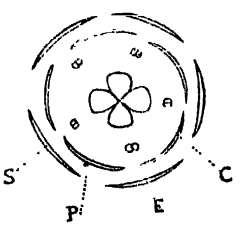


Fig. LXIX.

10. The FRUIT is the ripe pistil, containing the ovules arrived at the state of seeds. It may be very small, looking like a seed, as in the Sage and Wheat; or it may be large and fleshy, as in the Gourd and the Apple; or it may be hard and dry, as in the Cocoa Nut; or it may be thin and dry, splitting into pieces, as in the Lychnis. Its shell is called the *pericarp*. If it splits into pieces when ripe it is called *dehiscent*; if it does not split it is *indehiscent*. The pieces into which it splits are its *valves*.

All fruits which split into valves are commonly called *capsules*, with the exception of the *legume* or *pod* (Fig. LXXII.), which has two valves and a placenta on one side, as in the Pea; the *siliqua* (Fig. LXXIII.), or *silicula* (Fig. LXX.), which has two valves that separate from a frame, to which the placenta adheres all round, as in the Wallflower (Cheiranthus) and the Shepherd's Purse; the *follicle* which splits on one side only, through the placenta, as in the Stonecrop (Fig. LXXI.), and the *pyxis*, which throws off a cap, as in the Henbane (Hyoscyamus niger, Fig. LXXIV.).

The principal kinds of indehiscent fruits are the *drupe*, which has a hard stone covered with flesh, as the Peach (Amygdalus Persica); the *samara*,

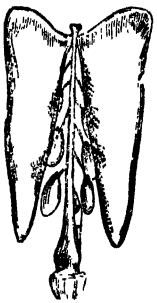


Fig. LXX.

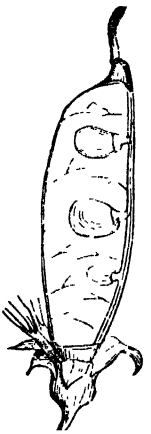


Fig. LXXII.

Fig. LXXIII.

which is thin and extended at the back into a wing, as in Sycamore (Acer Pseudoplatanus, Fig. LXXV.); the *nut*, which is large, hard, and dry, as in the Filbert (Corylus Avellana); the *achænium*, which is small, seedlike, dry, and separates from the seed, as in the Dead Nettle (Lamium); the *caryopsis*, which is small, seedlike, dry, and united with the seed, as in Wheat and other corn; the *utricle*, which is small and membranous, as in Chenopodium; and the *bacca* or *berry*, which is soft and fleshy, inclosing many seeds, as the Currant (Ribes rubrum) and Grape (Vitis vinifera).

F.LXXIV

11. The SEED is the full-grown ovule. It is the part which contains the *embryo* plant; its skin or coat is named *testa*, and the scar by which it adheres to the placenta is called the *hilum*.

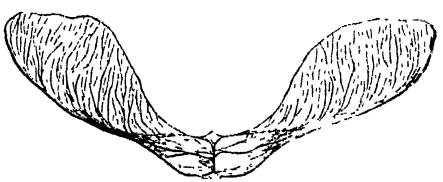


Fig. LXXV.

There is frequently interposed between the embryo and the seed-coat a substance called *albumen* (Fig. LXXVIII.), but it is quite as common to find the embryo without any such substance (Fig. LXXIX.)

Fig. LXXVI

The EMBRYO (Fig. LXXVIII. and LXXVII.) consists of three parts, the *radicle* (*r*), or young root, the *cotyledons* (*c*), or young leaves, and the *plumule* (*p*), or young stem. The latter can, however, only be seen in large seeds like the Garden Bean. If the embryo has two coty-

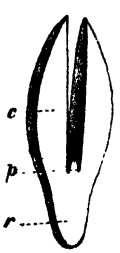


Fig. LXXVII.

Fig. LXXVIII.

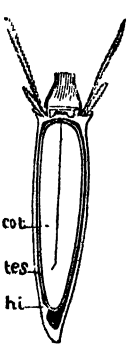


Fig. LXXIX.

ledons it is called *dicotyledonous*, as in the Bean (Fig. LXXVII.); if it has only one it is called *monocotyledonous*, as in Carex (Fig. LXXVIII.).

12. In addition to the parts already mentioned, the surface of plants is furnished with organs called *hairs*, *glands*, *scurf*, and *prickles*.

HAIRS are minute, soft, taper-pointed bodies which produce a white, or gray, or hoary appearance upon the part on which they grow. They give rise to the following names: *pubescent*, when they are short, soft, and thinly placed; *tomentose*, when they are short, soft, and closely placed; *pilose*, when they are long, soft, and thinly placed; *villous*, when they are long, soft, and thickly placed; *hirsute*, when they are long, harsh, and thickly placed. If hairs occupy only the edge of a body, it is said to be *ciliated*.

GLANDS are either hairs with a head or secreting organ, as in the Sweet-briar Rose (Rosa rubiginosa); or internal nuclei, such as may be seen in the rind of the Orange; or little tubercles upon various organs. This name is also given to the warts or callosities which appear on the leaves or other parts of some plants, as in the common Peach.

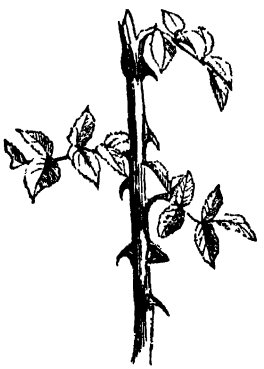


Fig. LXXX.

SCURFS (lepides) are roundish minute scales, attached to plants by their middle, as in the Sea Buckthorn (Hippophäe rhamnoides); a part covered by them is said to be *lepidote*.

PRICKLES (*aculei*) are hard, sharp, conical projections, usually found on the stem, as in the Rose, and originating in the bark, from which they are easily broken off (Fig. LXXX.).

The greater part of plants have all the preceding organs; but there are many which are destitute of one or other of them.

Some have no corolla, as Chenopodium, and are called *apetalous* or *monochlamydeous;* others have neither corolla nor calyx, as the Willow, and are *achlamydeous*. In particular species the stamens are found in one flower, and the pistil in another, as in Hemp (Cannabis sativa); such plants are called *unisexual*. If in such cases all the flowers of one plant are male or staminiferous, and all those on another are female or pistilliferous, such a plant is *dicecious;* but if both male and female flowers occur upon the same plant it is *monœcious;* and if on the same plant some flowers are male, others female, and others hermaphrodite, that is, composed of both organs, the term *polygamous* is employed. In describing plants the sign ♂ is often employed to indicate male, ♀ female, and ☿ hermaphrodite; ♂-♀ represents monœcious, ♂ ♀ dicecious, and ♂-☿-♀ polygamous. A very large number of plants, called *cryptogamous*, have neither stamens nor pistil, as Ferns. Some plants have no leaves, as Cuscuta, others have neither leaves nor stem, but the two combined into one common organ, as Lemna and Lichens; and no inconsiderable number have no distinct leaves, stem, or root, as Confervæ, and microscopical Fungi.

Moreover, among those plants which are most completely organised, some have many rows of each particular organ of fructification; for example, the Ranunculus and Strawberry have many rows of stamens, the Waterlily has many rows of petals, and sepals; others, on the contrary, have the number extremely small; thus Marestail (Hippuris vulgaris) has only one

stamen, Veronica only two, Grasses only three; Aconitum has only two petals, and Delphinium but four, while Aquilegia has five petals. And, in like manner, while the Strawberry has a great number of distinct ovaries, the Cherry has but one.

The result of such differences of structure, and of many others, is a great number of different species of plants, which it is the object of Systematical Botany so to *classify*, that a person unacquainted with them may find them in their places; that one already acquainted with them may, by turning to their station in the classification, know what is mentioned in books concerning them, and what other species are associated with them on account of their resemblance; and that those who have acquired more proficiency in the science may be able to judge of the uses or properties of an unknown species by comparing it in their minds with some other with which they are already acquainted.

This end is obtained in several different ways; the manner in which it has been accomplished by M. De Candolle is explained in the succeeding pages.

CHAPTER II.

CLASSES OF PLANTS.

If an observer, who had never heard anything of classification, were for the first time to arrange those plants known to him, it is probable that he would make use of such marks of difference as were anciently employed, and that his first classes would be trees, herbs, and grasses. But a little experience would show him that such an arrangement is vague and unsatisfactory; for he would not know where to place plants like Lavender, which is an herbaceous plant when young, and a small Tree when old; or the tree Mallow, which is a herb in the North of Europe, and a tree in the South; or the Palma Christi (Ricinus), which is an annual in England, and a tree 15 feet high in Barbary and Spain; or the Bamboo, which is a grass in its leaves and flowers, but a tree in stature. Hence he would be driven to have recourse to other marks of distinction; and, if his experience were sufficiently great, he would at last discover those characters employed by Botanists of the present day.

The writings of Botanists contain a great many kinds of classifications, among which one of the most celebrated is that of De Candolle, who divides plants into three classes,—*Exogens*, *Endogens*, and *Cryptogamic plants*, and distinguishes them in the following manner.

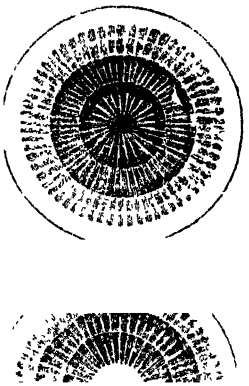
Exogens are all those plants whose leaves have their veins branched, and forming a sort of fine net-work (Fig. LXXXIII.); as in the common Dock (Rumex), the Currant, the Oak, the Elm, the Mallow, &c. If a cross section of the stem of such plants is examined (Fig. LXXXII.), it will be found to contain pith in the centre, then a ring of wood, and on the outside, a covering of bark. If the plant observed be a tree, it will be readily seen that fine lines proceed in a radiating manner from the pith to the bark; and if it is not a tree the same lines will be found, only with some difficulty: such lines are called *medullary rays*. Supposing the seed can be examined, its embryo will be seen to be dicotyledonous (Fig. LXXXI.), on which account Exogens are sometimes called *Dicotyledons*.

Fig. LXXXI.

In its growth an Exogen gradually increases in the thickness of its stem, by forming the new wood over the old wood, beneath the

bark; so that in an Exogen of a few years' growth there will be found as many concentric circles of wood as the plant is years old. In consequence of this, all the branches of Exogens are necessarily cones, for the lowest part must be the thickest, because it is the oldest.

It is very common to find that the number of parts in the flower of an



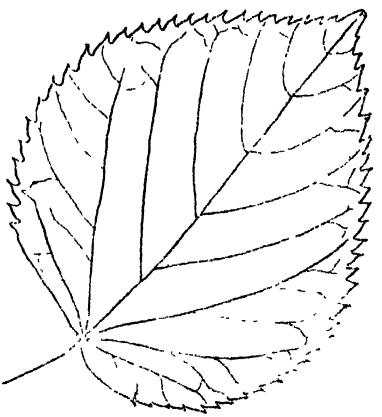


Fig. LXXXIII.

Fig. LXXXII.

Exogen is some power of 4 or 5; that is to say, that there are 5 sepals, and 5 petals, and 5, or 10, or 15, &c. stamens, and 5 carpels, as may be seen in the Apple Tree; and this number prevails in the calyx, corolla, and stamens.

A large part of all the European Flora consists of Exogens; all the trees and bushes found wild in the north of Europe are exclusively of this class, and a considerable proportion of the herbaceous plants.

Students are apt to suppose that plants whose leaves are cut into very fine divisions, as Fennel, and the Water Ranunculus (Fig. LXXXIV.) are parallel-veined, and consequently Endogens. It is therefore necessary to explain that all such divisions represent veins; that if they were put together by means of an ideal intervening membrane they would have a netted arrangement; and therefore they are Exogens. It is very uncommon to find the leaves of Endogens cut into capillary segments; the normal arrangement of their veins is opposed to such a separation.

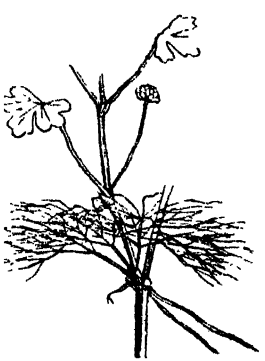


Fig. LXXXIV.

ENDOGENS include all those plants whose leaves have their veins placed parallel; as Grasses (Fig. LXXXV.), the Hyacinth, the Crocus, the Cornflag, &c. If a cross section of their stem (Fig. LXXXVI.) is examined, it presents to the eye no distinction of pith, wood, bark, and medullary rays, but

is merely a confused mass of pithy matter, in which woody bundles (or threads) are cut through, as in the Asparagus. The seed of an Endogen contains an embryo with only one cotyledon (Fig. LXXXVII.) on which account this class has been called *Monocotyledonous*.

In its growth, the stem of an Endogen increases but little in thickness; it lengthens, and becomes harder, by the introduction of new woody bundles into its interior; but, however old it may be, it never indicates its age by concentric circles of wood. For this reason it is generally cylindrical, not conical.

The number of parts of its flower is generally a power of three; that is to say, there are 3 sepals, 3 petals, 3, 6, 9, &c. stamens, and 3 carpels; as may be seen in the Iris, the Lily, and other plants.

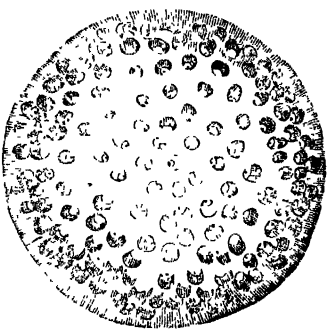


Fig. LXXXVI.

Fig. LXXXVII.

Compared with Exogens, the class of Endogens is rare in Europe, if we abstract Grasses and Sedges, which constitute so large a part of all European herbage. There are no trees of the class in Europe excepting in the hottest of its countries, where the Palmetto (Chamærops humilis), the Date Palm (Phœnix dactylifera), and the American Aloe (Agave Americana) are occasionally found either wild or naturalised.

Cryptogamic Plants, or Acrogens, differ essentially from the two other classes, in having no flowers, properly so called; multiplying themselves by bodies called spores. When they have stems, as in the Common Male Fern (Nephrodium Filix Mas), their wood is arranged in a zigzag manner, neither resembling the concentric circles of Exogens, nor the compressed, pithy, and fibrous structure of Endogens. If they have leaves, there is either no veins, or they are of the most simple kind, not branched or dividing at all; or, if they do branch, it is by continual forking. A large proportion of these plants have neither leaves, nor stems, properly so called; as is seen in Lichens, Confervæ, and Fungi. Since they have no flowers, they cannot produce seeds, and consequently they have no embryo. They however form bodies resembling seeds, answering the same purpose, and called *spores*.

The differences between the three classes of Exogens, Endogens, and Cryptogamic Plants may be briefly expressed thus:—

Classes.	Wood.	Leaves.	Flowers.	Embryo.
1. Exogens.	Concentric	Reticulated	4-5	Dicotyledonous.
2. Endogens.	Confused	Parallel-veined	3	Monocotyledonous.
3. Cryptogamic or Acrogens.	Sinuous, or 0.	Fork-veined, or 0.	0.	0.

In applying these differences to practice, it is necessary to attend to the following rules :—

The classes are not *absolutely* distinguished from each other by any one character, but by the *combination* of their characters. For this reason a plant may have one of the characters of a class to which it nevertheless does not belong, because its other characters are at variance with that class. Thus some species of Ranunculus have the flowers ⁵/ ; but they do not on that account belong to Endogens, because their wood is concentric, their leaves netted, and their embryo dicotyledonous. Arum maculatum has reticulated leaves ; but it is not an Exogen, because its wood is confused, and its embryo monocotyledonous ; its flowers are neither ⁴·⁵/ nor ³/, all the parts being in a state of peculiarly diminished structure. The genus Potamogeton has the flowers ⁴/ ; yet it does not belong to Exogens, because its leaves have parallel veins, and its embryo is monocotyledonous.

In estimating their value, the characters of the classes are to be placed thus :—1. Wood. 2. Embryo. 3. Leaves. 4. Flowers. The structure of the wood is of more importance than all the others, because it indicates a whole series of differently modified vital phænomena ; the embryo is of more importance than the leaves, because it is the part which determines all the final structure of the plant ; and the leaves are of more importance than the flowers, because they are intimately connected with the peculiar manner in which the wood of the stem is organised, and determine in the first instance the organisation of the flower itself.

Nevertheless, in practice, the leaves and flowers are the parts usually consulted, because they are the most readily seen, and because they are good external signs of internal organisation.

In judging of the number of parts in a flower, attention should be first given to the number of carpels ; if they are 3, and all the surrounding parts are also a power of the same number, the plant will be an Endogen ; but if they are not ³/, or if, being some power of that number, the surrounding parts are ⁴·⁵/, the plant will, in all probability, be an Exogen.

When leaves have only a single vein, or are so narrow that there is not room for any side veins to grow, as in Fir trees (Abies) and others, no opinion as to whether such plants are Exogens or Endogens can be formed from the inspection of their foliage. But if the leaves have a contracted base, and are obviously articulated with the stem, they generally indicate an Exogen ; on the contrary if they are not contracted at the base, and do not disarticulate from the stem, they generally indicate an Endogen.

CHAPTER III.

OF THE SUBDIVISIONS OF EXOGENS.

The Class of Exogens is divided by De Candolle into four sub-classes, characterised as follows :—

Sub-class 1. *Thalamiflorœ.*—Flowers furnished with both a calyx and corolla, the latter consisting of distinct petals. Stamens always hypogynous, or united to the sides of the ovary.—p. 24.

Sub-class 2. *Calyciflorœ.*—Flowers furnished with both a calyx and corolla, the latter usually consisting of distinct petals. Stamens always perigynous.—p. 52.

Sub-class 3. *Corolliflorœ*.—Flowers furnished with both calyx and corolla, the latter consisting of united petals.*—p. 73.

Sub-class 4. *Monochlamydeœ*.—Flowers having no corolla, and sometimes not even a calyx.—p. 109.

Of these sub-classes the two first are usually Polypetalous, the third is Monopetalous, and the fourth is Apetalous; so that they might be considered as only three sub-classes, of which one is subdivided according to the manner in which the stamens are inserted. In this point of view the differences of the sub-classes might be, in most cases, expressed thus :—

1. Polypetalous,
   Stamens hypogynous . . . = *Thalamiflorœ*.
   Stamens perigynous . . . = *Calyciflorœ*.
2. Monopetalous . . . . . = *Corolliflorœ*.
3. Apetalous . . . . . = *Monochlamydeœ*.

It is, however, to be observed, that some of the Calycifloræ and Thalamifloræ have a monopetalous corolla.

In this classification the student proceeds from what are considered the most perfectly organised Exogens to those which are least so. Thus all the parts are present and distinct from each other in Thalamifloræ; other things remaining the same, the stamens adhere to the calyx in Calycifloræ; the stamens join the petals, and the petals each other in Corolliflorœ; and in Monochlamydeœ, first the corolla disappears, and then, among the most incomplete orders, the calyx also ceases to be developed.

CHAPTER IV.

OF THALAMIFLORAL EXOGENS.

Of this subclass there are 19 principal orders belonging to the European Flora; namely,—

Ranunculaceæ; Berberidaceæ; Nymphæaceæ; Papaveraceæ; Fumariaceæ; Cruciferæ, or Brassicaceæ; Cistaceæ; Violaceæ; Droseraceæ; Polygalaceæ; Caryophyllaceæ; Linaceæ; Malvaceæ; Tiliaceæ; Hypericaceæ; Aceraceæ; Geraniaceæ; Oxalidaceæ; Rutaceæ; which are placed in their present order by M. De Candolle, who distributes them through 5 *cohorts*. But as no idea of the nature or limits of these cohorts can be formed from a consideration of the Flora of Europe alone, it will be better to view the foregoing orders, and all future cases of a like nature, without reference to anything further than their differences from each other. For this purpose they may be briefly and differentially characterised as follows :—

Ranunculaceœ.—Sepals and petals 3, 4, 5 each. Stamens numerous. Anther-valves straight. Carpels more or less distinct.

Berberidaceœ.—Sepals, petals, and stamens, 6 or 8 each. Stamens opposite the petals, and equal to them in number. Anther-valves recurved. Carpel solitary.

Nymphæaceœ.—Sepals, petals, and stamens numerous. Carpels combined into a pistil of many cells, with the ovules growing all over the sides of the dissepiments.

Papaveraceœ.—Sepals 2; petals 4. Stamens numerous. Carpels combined into a pistil of one cell, with parietal placentæ.

Fumariaceœ.—Sepals 2; petals 4. Stamens 6, in 2 parcels. Carpel solitary or two united, with parietal placentæ.

Brassicaceœ or Cruciferœ.—Sepals and petals 4 each. Stamens tetradynamous.† Fruit a siliqua or silicula.

Cistaceœ.—Sepals and petals 5 each,

* Strictly speaking, De Candolle excludes from this class all the Monopetalous orders in which the stamens are not attached to the corolla. But for beginners it is better to make the monopetalous structure the mark of Corolliflorals

† Τετρα four, and δυναμις power. The stamens are supposed to form four distinct forces, two of which consist of single stamens, and two of twin ones. The name Tetradynamia was, on that account, given by Linnæus to a class having six stamens, four of which are long, and

the latter crumpled. Stamens numerous. Carpels consolidated into a 1-celled ovary with parietal placentæ. Seeds with the radicle at their point.

Violaceæ.—Flowers irregular. Sepals and petals 5 each. Stamens 5. Anthers with a membranous crest. Carpels combined into a 1-celled pistil, with 3 parietal placentæ. Style single.

Droseraceæ.—Flowers regular. Sepals and petals 5 each. Stamens ∞. Carpels combined into a 1-celled pistil with 3-5 parietal placentæ. Styles 3 or 5.

Polygalaceæ.—Sepals 5; very irregular, two petaloid. Petals 3; unequal, combined into a carinate lip. Stamens monadelphous; anthers 1-celled, opening by a pore. Carpels combined in a 2-celled ovary, with solitary pendulous ovules.

Caryophyllaceæ.—Sepals and petals 5 each. Stamens ∞. Carpels combined into a 1-celled pistil with a free central placenta. Stigmas several, distinct.

ɤ.—Sepals and petals each, imbricated. Stamens 8-10, monadelphous, half abortive. Carpels combined into a many-celled pistil with pendulous solitary ovules. Stigmas distinct.

Malvaceæ.—Sepals valvate, 5; petals 5. Stamens numerous, monadelphous in a columnar manner. Carpels combined into a many-celled pistil, with solitary ovules.

ε.—Like Malvaceæ, but stamens distinct.

Hypericaceæ.—Sepals and petals 5 each, dotted; the latter unequal-sided. Stamens numerous, polyadelphous. Carpels combined into a pistil with several cells. Styles distinct.

Aceraceæ.—Sepals and petals 5 each. Stamens 8. Carpels combined into a 2-lobed, 2-celled pistil. Style 1. Fruit samaroid.

ceæ.—Sepals and petals 5 each. Stamens 10, in part abortive. Carpels 5, combined into a pistil with 5 cells, and a long beak. Fruit, with a long beak, round which the ripe elastic carpels are arranged.

Oxalidaceæ.—Sepals and petals 5 each. Stamens 10, monadelphous. Carpels united into a pistil with 5 polyspermous cells. Stigmas distinct. Fruit bursting with elasticity.

Rutaceæ.—Sepals and petals dotted, 4-5 each. Stamens of the same power as the sepals. Carpels combined into a 4 or 5-lobed pistil, with as many cells as lobes, and 1 or 2 ovules in each. Style simple. Fruit bursting with elasticity.

The application of the preceding characters requires to be conducted with very great care, for a small error in the application of the distinctions will lead to great error. By way of a check upon the examination of the plants first taken for study, some assistance will be derived from the following tabular view, which comprises a few additional characters beyond those above given:—

A. *Stamens indefinite; that is to say, more numerous than can be easily counted.*
- *a.* Carpels either wholly or in part distinct from each other . *Ranunculaceæ.*
- *b.* Carpels united into a pistil having more than one placenta.
  - *α.* Ovary 1-celled, with parietal placentæ. Sepals deciduous. *Papaveraceæ.*
  - *β.* Ovary 1-celled, with parietal placentæ. Sepals 3 or 5, permanent, and much imbricated . . . *Cistaceæ.*
  - *γ.* Ovary many-celled, with 4 sepals, many petals, stamens adhering more or less to ovary, and ovules growing all over the sides of the dissepiments . . . . *Nymphæaceæ.*
  - *δ.* Ovary many-celled, with imbricated dotted sepals, unequal-sided petals, polyadelphous stamens, many styles, and ovules growing in the axis of the ovary . . *Hypericaceæ.*
  - *ε.* Ovary many-celled, with valvate sepals, and columnar stamens. *Malvaceæ.*
  - *ζ.* Ovary many-celled, with valvate sepals, and distinct stamens. *Tiliaceæ.*

B. *Stamens definite; that is to say, obviously corresponding in number with the sepals and petals.*
- *a.* Flowers tetradynamous. *Brassicaceæ.*
- *b.* Flowers unsymmetrical, with 8 stamens, and a samaroid fruit . *Aceraceæ.*
- *c.* Flowers unsymmetrical, with 2 petaloid and 3 herbaceous sepals. *Polygalaceæ.*
- *d.* Flowers symmetrical.
  - *α.* Flowers irregular, with 2 minute sepals, and 4 closely pressed petals, in 2 rows, and diadelphous stamens. *Fumariaceæ.*
  - *β.* Flowers irregular, with 5 equal sepals, 5 petals in one row, and free stamens
  - *γ.* Flowers regular, with recurved anther-valves . . *Berberidaceæ.*
  - *δ.* Flowers regular, with straight anther-valves, parietal placentation, and gyrate foliation . *Droseraceæ.*
  - *ε.* Flowers regular, with straight anther-valves, a free central placenta, and opposite entire leaves with tumid nodes. *Caryophyllaceæ.*

ζ. Flowers regular, with the placenta in the axis.

*** Carpels 1-seeded, surrounding a long beak. Leaves with stipules. *Geraniaceæ.*

** Carpels 1- or 2-seeded, not surrounding a beak. Stamens monadelphous . . . . . *Linaceæ.*

*** Carpels 1- or 2-seeded, not surrounding a beak. Stamens free. Leaves dotted . . *Rutaceæ.*

*** Carpels many-seeded.

The following is a more detailed account of these orders, and of some of the common genera and species belonging to them:—

ORDER I. NYMPHÆACEÆ—WATER LILIES.

Essential Character.—*Sepals* and *petals* numerous, imbricated, passing gradually into each other; the former persistent, the latter inserted upon the disk which surrounds the pistil. *Stamens* numerous, inserted above the petals into the disk, sometimes forming with the combined petals a superior monopetalous corolla; *filaments* petaloid. *Disk* large, fleshy, surrounding the ovary more or less. *Ovary* polyspermous, many-celled, with the stigmas radiating from a common centre upon a cap. *Fruit* many-celled, indehiscent. *Seeds* numerous, attached to spongy dissepiments, and enveloped in a gelatinous aril.—*Herbs*, with peltate or cordate fleshy leaves, arising from a prostrate trunk, growing in quiet waters.

*** These are what we commonly call *Water Lilies.* They are known from Ranunculaceæ by their permanent calyx and consolidated carpels, and from Papaveraceæ by their perfect dissepiments covered over with seeds, and by being floating water plants.

NYMPHÆA.

Sepals 4. Petals numerous, larger than the sepals. Stamens united to the sides of the ovary. Stigma with many rays.

1. N. *alba* (*White Water Lily*). Leaves roundish, deeply cordate, quite entire. Flowers white. ——— *Stagnant or slowly running water.*

Sepals 5. Petals numerous, small, with a honey-pore at the back. Stamens distinct from the ovary. Stigma stellate, toothed.

1. N. *luteum* (*Yellow Water Lily*). Leaves oval, split at the base for a third of their breadth. Flowers yellow. ——— *Stagnant or slowly running water.*

ORDER II. RANUNCULACEÆ—CROWFOOTS.

Essential Character.—*Sepals* 3-6, usually deciduous, sometimes unequal. *Petals* 3-15, in one or more rows, distinct, sometimes unequal, sometimes partly or wholly missing. *Stamens* indefinite in number, hypogynous. *Carpels* numerous, seated on a torus, 1-celled or united into a single many-celled pistil. *Fruit* either consisting of dry achænia, or baccate with one or more seeds, or follicular with one or two valves.—*Herbs*, or very rarely *shrubs*. *Leaves* alternate or opposite, generally much divided, with the petiole dilated and forming a sheath half clasping the stem. *Stipules* occasionally present. *Hairs*, if any, simple. *Inflorescence* variable.

*** These plants are generally distinguished from Rosaceæ, which they often resemble, by having a deciduous calyx to which the stamens do not adhere; the latter part of this character is the most important, because Pæonia, which belongs to Ranunculaceæ, has a permanent calyx.

CLEMATIS.

Sepals 4, valvate, coloured inside. Petals missing. Carpels one-seeded achænia.

Fig. LXXXVII. *b*

1. C. *Vitalba* (*Travellers' Joy*). Stem woody, climbing. Leaves pinnate; leaflets 5, heart-shaped, unequally cut. Achænia with long feathery tails.— *Flowers white. Common in hedges, which are covered in autumn with its long shaggy carpels. An*

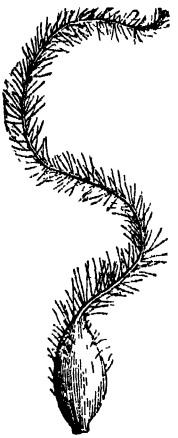


Fig. LXXXVII. *a*

ANEMONE.

Calyx with five or more imbricated sepals, coloured like a corolla, and assuming the appearance of one, usually with an involucre a little below it. Achænia one-seeded, placed upon an elevated receptacle, and terminated by long feathery styles, or closely covered with wool.

1. A. *Pulsatilla* (*Pasque Flower*). Leaves tripinnatifid with linear acute segments. Flower erect, hairy, purple, campanulate at the base, reflexed at the edge. Leaves of the involucre sessile, many-parted. Fruit terminated by long hairy tails.———*Chalky hills.*

2. A. *coronaria* (*Garden Anemone*). Leaves ternate, with multifid linear mucronate segments. Involucre sessile. Flowers of about six sepals, large, hairy, red, white, or purple. Fruit buried in wool.———*South of Europe. Common in gardens.*

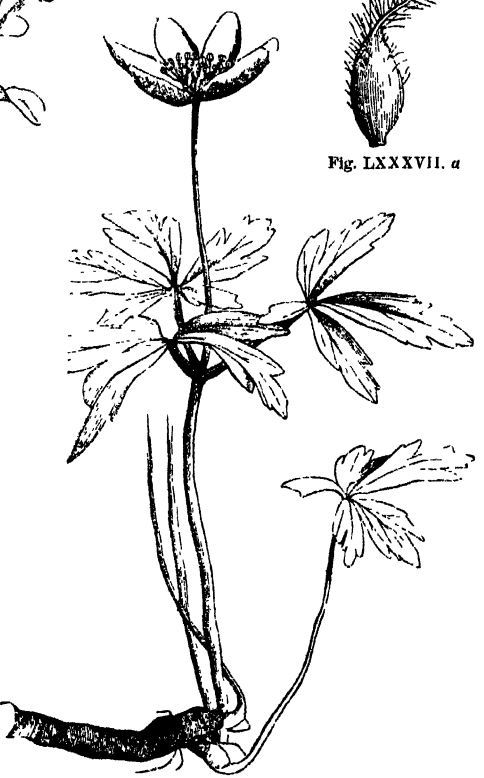


Fig. LXXXVII. *c.*

3. A. *nemorosa* (*Wood Anemone*). Leaves ternate. Leaflets lanceolate, lobed, and cut. Involucre very like them. Stem one-flowered, undivided. Sepals 6. Fruit awnless.———*In woods, not uncommon, flowering in April.* Flowers snow white.

Fig. LXXXVII. *a.*—Achænium of Clematis Vitalba. Fig LXXXVII *b.*—A portion of its inflorescence. Fig. LXXXVII *c.*—Anemone nemorosa.

CALTHA.

Sepals 5, in the position of the calyx, but with the colour and texture of petals. Capsules 5-10, many-seeded

1. C. *palustris* (*Marsh Marigold*) Stem ascending. Leaves roundish cordate, minutely crenated. — — — — *Meadows and wet ditches. Flowers large, yellow.*

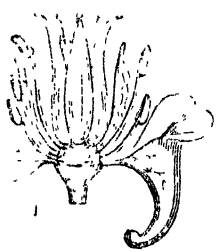
THALICTRUM.

Sepals 4-5 imbricated. Petals missing. Achænia without awns.

1. T. *flavum* (*Meadow Rue*). Stem erect, branched, furrowed Leaves bipinnate: leaflets broadly-obovate, or wedge-shaped, three-lobed. Panicle compact. ——— *Moist meadows and ditches. Stem 2-3 feet high. Flowers yellow.* Differs from Actæa in having dry pedicel late fruits.

Sepals 5, petal-like. Petals 5, funnel-shaped, with a spur at the base. Capsules 5.

1. A. *vulgaris* (*Columbine*). Leaves biternate; leaflets 3-lobed, with ovate, rounded crenatures. Spurs hooked at the point. Flowers blue. ——— *Hedges and thickets. Common in gardens.*



DELPHINIUM

Sepals 5, petaloid, very irregular; the upper one with a spur. Petals 4: the two upper spurred, included in the spur of the upper sepal: the other two convex and spurless, often hairy in the middle. Capsules 1--5, many-seeded.

Several species common in gardens, under the name of Larkspurs.

Fig. LXXXVIII 2

ACONITUM.

Sepals 5, petal-like, very irregular, the upper arched. Petals 2, hooded, spurred, with long stalks; three others very small, scale-like, often wanting. Carpels 3-5, many-seeded.

1. A. *Napellus* (*Monkshood*). Stem leafy, erect, about three feet high. Leaves divided palmately into many narrow lobes. Flowers in nearly simple racemes, downy. Upper sepal very convex and compressed. Petals with a curved stalk, horizontal. Seeds 3-cornered, with many plaited wrinkles at the back. ———

Fig. LXXXVIII.—Aquilegia vulgaris. 1. A flower divided vertically, with one sepal and one petal, some stamens and the pistil; 2. a vertical section of a seed, showing the embryo at one end of the albumen.

Common in gardens. Alps of Europe. Flowers large, violet. A most dangerous poison. The roots especially, which somewhat resemble a cluster of radishes (*see Flora Medica, fig.* 21), have been mistaken for horse-radish, with fatal consequences.

2. A. *Lycoctonum* (*Wolfsbane*). Stem straggling. Leaves palmate. Flowers yellow, in panicled racemes. Upper sepal elongated, bluntly saccate. ——*Common in Gardens. Alps of Europe.* Less poisonous in this country than the foregoing.

3. A. *variegatum.* Stem erect, branching. Flowers white, blue, or variegated with those colours, in erect panicled racemes. Upper sepal almost semicircular, with a short beak. Flower-stalks usually smooth. ——*Common in Gardens. Alps of Europe.* There is a very dark purple variety, which resembles A. Napellus; but it flowers later, and is easily known by its shining hairless great branched panicles.

N.B.—Botanic Gardens abound with bad species, formed by the Germans out of the two first of these common plants.

Fig LXXXVIII *b*

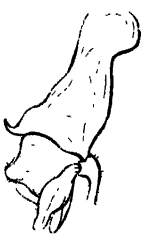


Fig LXXXVIII *c*

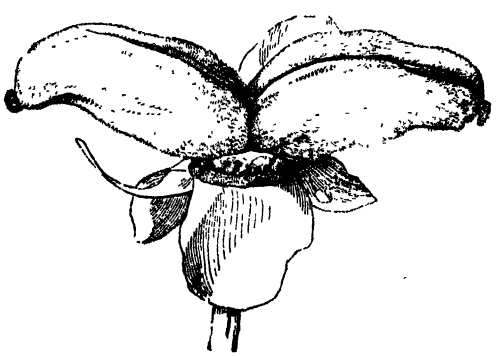


Fig. LXXXVIII

PÆONIA

Sepals 5, permanent, unequal, herbaceous. Petals 5, or more. Carpels 2 or 3, many-seeded, opening by their inner face when ripe.

1. P. *officinalis* (*Common Peony*). Leaves biternate, or ternate-bipinnate; leaflets oblong or lanceolate, smooth on both sides. Stem obsoletely angular. ——*Gardens. Woods of Europe.*

Fig. LXXXVIII. *b*—Inflorescence of Aconitum Napellus. Fig LXXXVIII. *c*.—Flower of Aconitum Lycoctonum. Fig LXXXVIII. *d*.—Fruit of Paeonia officinalis

ADONIS.

Sepals 5. Petals 5, or more, without a nectariferous scale at the base. Carpels numerous seed-like achænia.

N.B.—This genus differs from Ranunculus in nothing except the want of a scale at the base of the petals.

1. A. *vernalis*. Perennial. Petals numerous. Carpels hooked.——*Common in gardens, flowering in the early spring. Flowers large, yellow.*

2. A. *autumnalis* (*Pheasant's eye*). Annual. Petals 5. Carpels with a straight style.——*Common in gardens. Continent of Europe. Flowers crimson or yellow.*

MYOSURUS.

Sepals 5, spurred. Petals 5, tubular. Stamens only 5. Achænia CO, on a very long slender curved axis.

1. M. *minimus* (*Mouse-tail*). Only 2 or 3 inches high. Leaves almost linear, fleshy. Flowers small, greenish.——*Corn-fields, &c.*, flowering in May and June.

RANUNCULUS.

Sepals 3 or 5. Petals the same number, with a nectariferous scale at the base. Carpels numerous, seed-like.

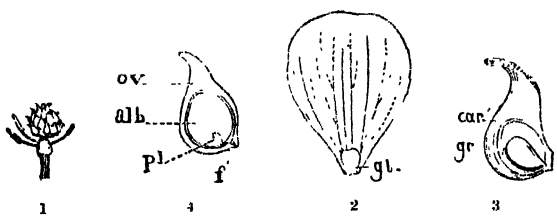


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Fig. LXXXIX.

1. R. *aquatilis*. A floating plant. The floating leaves reniform, lobed or split; the submersed leaves cut into fine segments. Flowers white. —— *Common in ponds and ditches.*

2. R. *hederaceus*. A floating plant. The leaves all alike, reniform, obsolete 5-lobed. Flowers white. —— *Common in ponds and ditches.*

3. R. *Flammula*. Leaves elliptical lanceolate or linear. Stems ascending or prostrate, often rooting, many-flowered. Carpels obovate, smooth, obscurely bordered, with a short terminal point. —— *Ditches and wet meadows.*

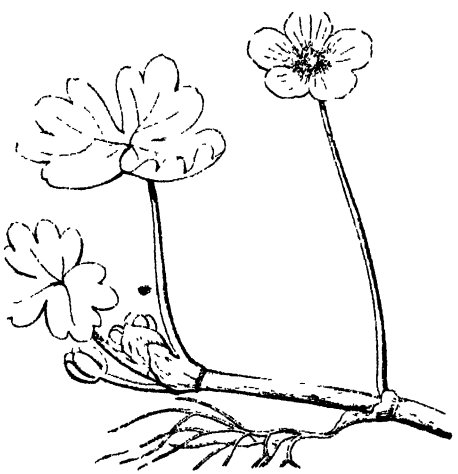


Fig. XC.

4. R. *acris*. (*Crowfoot.*) Root-leaves divided in a palmate manner; the segments somewhat lozenge-shaped, cut, and sharply toothed; the leaves of the stem the same shape, the uppermost divided into 3 linear segments. Stem many-flowered. Peduncles tapering, Carpels lenticular, compressed, bordered, with a beak, which is rather curved, and much shorter than the carpel. Receptacle smooth. —— *Common in meadows and*

Fig LXXXIX.—Ranunculus repens. 1. Carpels and stamens; 2. petal; *gl.* gland; 3 perpendicular section of the carpel *gr.* ovule; *car.* carpel; 4. perpendicular section of a ripe fruit; *f.* foramen; *pl.* embryo, *alb.* albumen; *ov.* ovary.

Fig XC.—Ranunculus aquatilis.

5. R. *bulbosus*. Root-leaves ternate or biternate; the leaflets trifid, cut and toothed. Peduncles furrowed. Sepals reflexed. Carpels lenticular, compressed bordered, smooth. Stem bulbous at the base.——*Common in meadows.*

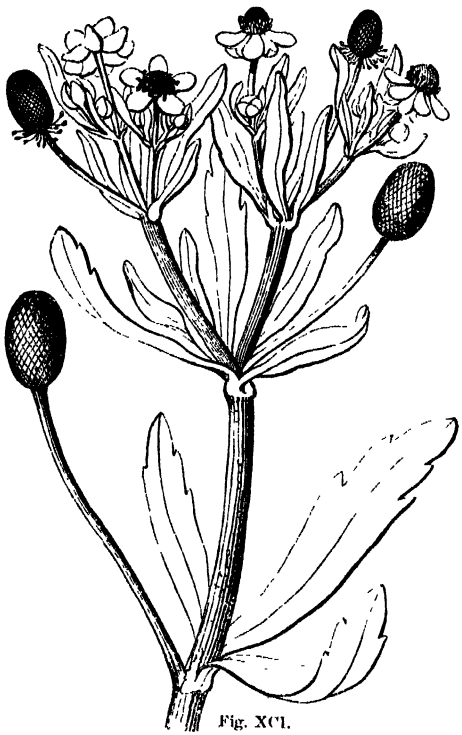


Fig. XCI.

6. R. *sceleratus*. All the parts very smooth and watery. Lower leaves palmate, with crenated incisions, upper trifid with linear segments. Sepals reflexed. Head of carpels long and narrow.——*Wet ditches.*

7. R. *Ficaria* (*Lesser Celandine, Pilewort*). Leaves heart-shaped, stalked, angular, very shining. Sepals 3. Petals 9. ——*In plantations, and among grass under trees. Flowers yellow, glossy.* The roots have long fig-like fibres.

8. R. *repens*. Stems prostrate and creeping. Leaves with 3 stalked leaflets, which are 3-lobed and cut in various ways. Calyx spreading. Flower stalks furrowed——*Very common in pastures. Flowers yellow.*

9. R. *Lingua* (*Serpent's tongue*). Leaves long, lanceolate, somewhat serrated, often hairy. Stem quite erect. Carpels with a broad shortly ensiform beak. ——*Wet Ditches. Flowers showy.* This differs from R. Flammula, No. 3, in being much larger, more usually hairy, with a stout erect stem. The ripe carpels, too, or achænia, have a broad sword-shaped beak, and not a mere point.

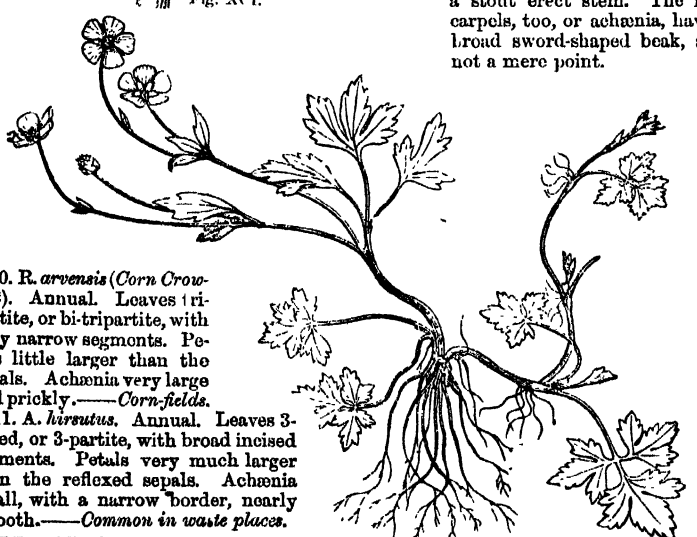


Fig. XCII.

10. R. *arvensis* (*Corn Crowfoot*). Annual. Leaves tripartite, or bi-tripartite, with very narrow segments. Petals little larger than the sepals. Achænia very large and prickly.——*Corn-fields.*

11. A. *hirsutus*. Annual. Leaves 3-lobed, or 3-partite, with broad incised segments. Petals very much larger than the reflexed sepals. Achænia small, with a narrow border, nearly smooth.——*Common in waste places.*

N.B.—All these plants are very

Fig. XCI.—Ranunculus sceleratus.

Fig XCII — R. ra[illegible]

acrid, and will blister the skin when tied down upon it. The gay Ranunculus so much prized by gardeners is the *R. Asiaticus*.

ACTÆA.

Sepals 4, very deciduous. Petals 4, minute. Carpel solitary, many-seeded, with a blunt sessile stigma. Fruit a succulent berry, with numerous seeds.

1. A. *spicata* (*Baneberry or Herb Christopher*). Stem erect. Leaves triternate, with ovate serrated leaflets. Raceme simple. Fruit oblong, dark purple.——*In calcareous elevated districts. Rare. Extremely poisonous. Flowers tinged with pink and green.*

Fig. XCII. *b*.

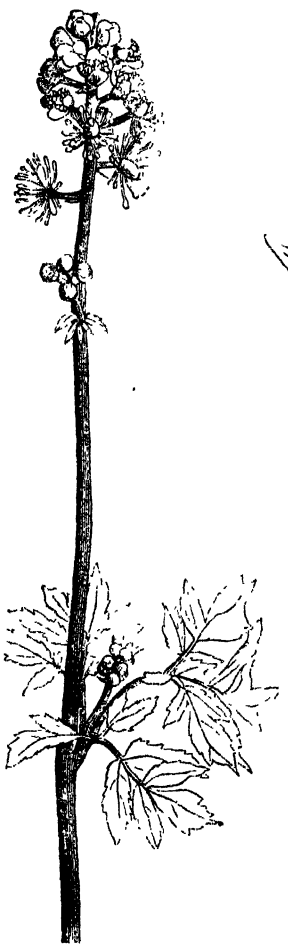


Fig. XCII *c*.

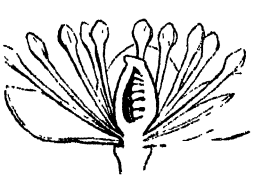


Fig. XCII *d*.

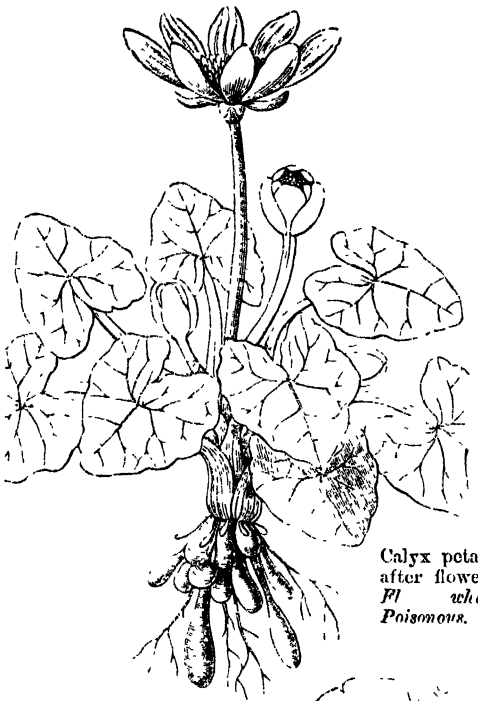


Fig XCII.

ERANTHIS

Sepals petaloid, 5-8, deciduous. Petals smaller, long-stalked, tubular. Follicles numerous, many-seeded, stipitate.

1. E. *hyemalis* (*Winter Aconite*). Stem simple. Leaves thin, smooth, 5-parted with deeply divided wedge-shaped lobes and narrow blunt segments. Involucre many-leaved, larger than the calyx.——*Germany. Common in gardens in the earliest spring. Flowers solitary, yellow.*

HELLEBORUS

Sepals 5, herbaceous or petaloid, persistent. Petals 00, unguiculate, tubular. Follicles few, sessile.

1. H. *niger* (*Christmas Rose*). Radical leaves pedate. Scape 1—2-flowered. Calyx petaloid, becoming herbaceous after flowering.——*S. East of Europe. Fl white, appearing in mid-winter. Poisonous.*

2. H. *fœtidus* (*Stinking Hellebore*). Stem leafy, many-flowered: only lower leaves pedate, upper trifid with a dilated petiole. Calyx always herbaceous. —— *Woods and waste places. Flowers green. A dangerous poison. The whole plant with a heavy nauseous odour.*

3. H. *viridis* (*Green Hellebore*). Stem leafless, except at the ramifications. Lower leaves pedate, with long narrow channelled recurved segments and projecting veins.—— *Wood and waste places. Flowers green. Poisonous like the last.*

Fig XCIII. *b.*

Fig. XCII.—Ranunculus Ficaria. Fig. XCIII. *b.*—Helleborus niger.

ORDER III. PAPAVERACEÆ—POPPYWORTS.

ESSENTIAL CHARACTER.—*Sepals* 2, deciduous. *Petals* either 4, or some multiple of that number. *Stamens* hypogynous, generally very numerous; *anthers* 2-celled, innate. *Ovary* 1-celled, with parietal placentæ. *Stigmas* 2 or many; in the latter case stellate upon the flat apex of the ovary. *Fruit* 1-celled, either pod-shaped with 2 parietal placentæ, or capsular, with several placentæ. *Seeds* numerous. —*Herbaceous* plants or *shrubs*, with a milky juice.

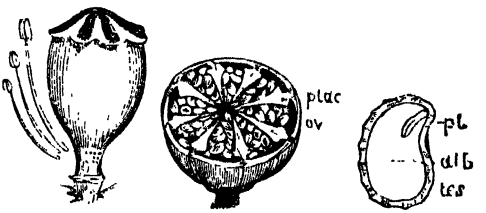


Fig. XCI

*** Readily known by their deciduous calyx and parietal placentæ. The former character divides them from Cistaceæ; the latter from Ranunculaceæ and Nymphæaceæ. They are known from Brassicaceæ or Cruciferæ, by their stamens not being tetradynamous.

PAPAVER.

Sepals 2. Petals 4, crumpled. Stamens very numerous. Ovary roundish, with many placentæ; stigma radiating

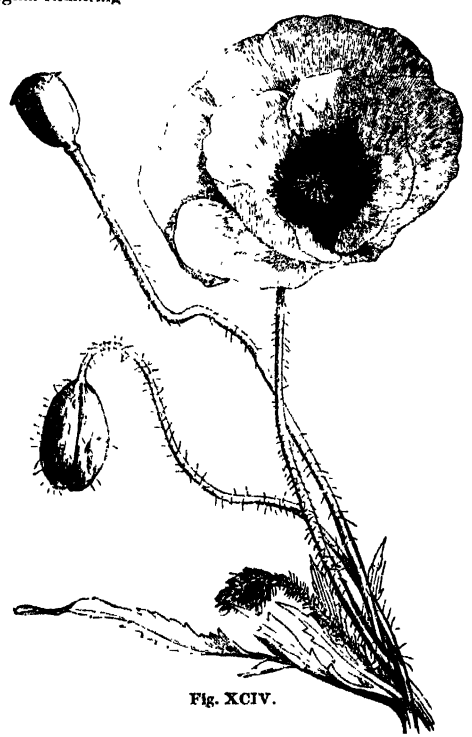


Fig. XCIV.

r Rhœas. 1. Pistil with three stamens, separated from their place; 2. a cross
c. the placentæ; *ov.* the ovules. 3. a perpendicular section of the seed;
; *tes* testa Fig XCIV.—Papaver Rhœas.

1. P. *Rhœas* (*Redweed, Red Poppy*). Leaves pinnate or tripinnate ; with oblong, lanceolate cut and toothed segments. Filaments subulate. Capsule obovate, rounded at the base, smooth. ———— *Corn fields and among rubbish.*

CHELIDONIUM.

Sepals 2. Petals 4. Stamens many. Capsule pod-shaped, 2-valved, with 2 placentæ.

Fig XCV

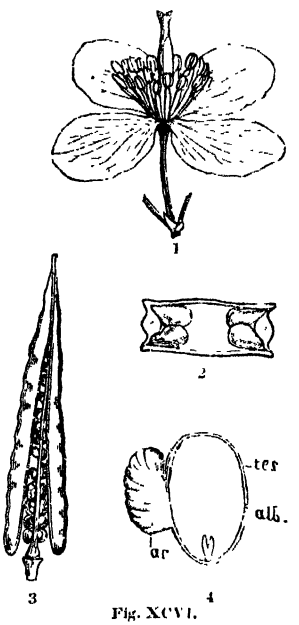


Fig. XCVI.

1. C. *majus* (*Celandine*). Leaves very deeply pinnatifid, with rounded notched lobes. Flowers small, yellow, in umbels. All the parts yielding an orange-coloured juice. ——. *Waste places.*

ORDER IV. FUMARIACEÆ.—FUMEWORTS.

ESSENTIAL CHARACTER.—*Sepals* 2, deciduous. *Petals* 4, cruciate, parallel; the 2 outer, either one or both, saccate at the base ; the two inner callous and coloured at the apex, where they cohere and enclose the anthers and stigma. *Stamens* 6, in two parcels, opposite the outer petals. *Ovary* superior ; *ovules* horizontal ; *style* filiform ; *stigma* with two or more points. *Fruit* various ; either an indehiscent nut, or a 2-valved pod. *Herbaceous*

Fig. XCV.—Chelidonium majus.

Fig. XCVI.—Chelidonium majus. 1. An expanded flower ; 2. a cross section of the ovary, showing the parietal placentæ ; 3. a seed-vessel in the act of throwing off its valves ; 4. a vertical section of a seed ; *ar.* aril ; *tes.* testa ; *alb.* albumen.

plants, with brittle stems and a watery juice. *Leaves* usually alternate, multifid, often with tendrils. *Flowers* purple, white or yellow.

*** The two small sepals, 4 irregular petals firmly adhering at the tips, and the diadelphous stamens, at once mark this order.

FUMARIA.

Sepals 2, minute. Petals 4, the upper one spurred at the base. Fruit a one-seeded nut.

1. *F. officinalis* (*Fumitory*). Leaves in many linear-oblong segments. Racemes lax when in fruit. Flowers pale purple, small. Fruit round, depressed at the end. ——— *Hedges and waste places.*

ORDER V. CRUCIFERÆ, OR BRASSICACEÆ—CRESSWORTS.

ESSENTIAL CHARACTER.—*Sepals* 4, deciduous. *Petals* 4, cruciate. *Stamens* 6, of which 2 are shorter, solitary ; and 4 longer, in pairs. *Disk* with various green glands between the petals and the stamens, and ovary. *Ovary* superior, with parietal placentæ usually meeting in the middle, and forming

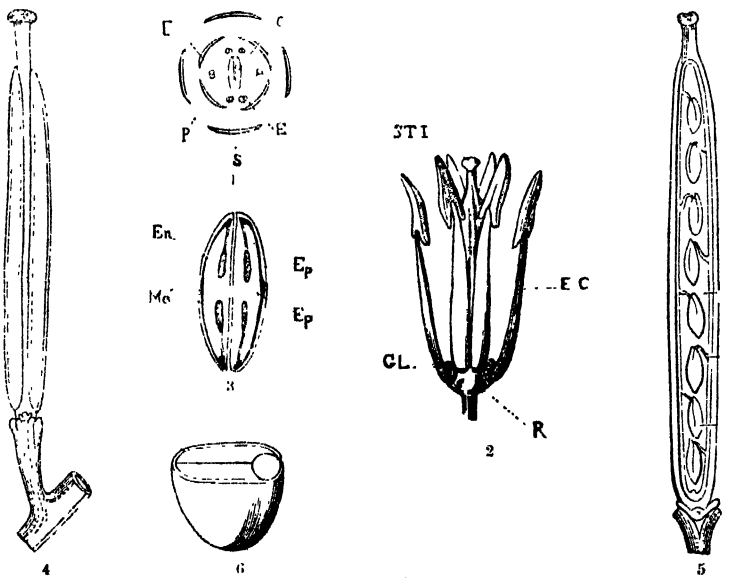


Fig. XCVII.

a spurious dissepiment. *Stigmas* 2, opposite the placentæ. *Fruit* a silique or silicule, 1 celled, or spuriously 2 celled ; 1 or many seeded ; dehiscing by two valves separating from the frame ; or indehiscent. *Seeds* attached in a single row to each side of the placenta, generally pendulous. *Albumen* none. *Embryo* with the radicle folded upon the cotyledons.—*Herbaceous* plants, annual, biennial, or perennial, very seldom suffruticose. *Leaves* alternate. *Flowers* usually yellow or white, seldom purple, without bracts.

*** No other order has tetradynamous stamens. Various methods have been proposed for arranging the genera of this difficult order. That of De Candolle, from the manner in which the embryo is folded up, is usually followed ; but the characters on which it depends are too minute for use by beginners.

Fig. XCVII.—Cheiranthus Cheiri 1. Diagram of the flower; *s.* sepals ; *p.* petals ; *e.* stamens; *c.* carpel. 2. The tetradynamous stamens; *gl.* glands of the disk ; *r.* receptacle ; *sti.* stigma ; *e c* short stamens. 3 Ideal plan of the fruit ; 4. ripe fruit ; 5. the same with one valve removed ; 6. cross section

§ 1. LOMENTACEÆ. *Fruit separating transversely into one or many seeded joints.*

RAPHANUS.

Calyx with two pouches at the base. Petals obovate or obcordate. Silique taper, many-celled transversely, with a long, conical, taper-pointed style. Seeds globose, in one row.

1. R. *sativus* (*Garden Radish*). Root fleshy, long or round. Leaves lyrate, with rough hairs. Flowers light purple. Siliques knotted, hardly longer than their stalks. ——— *Common in gardens.*

§ 2. SILICULOSÆ. *Fruit a silicle, that is, about as broad as long.*

CORONOPUS.

Silicle double; valves ventricose or slightly carinate, scarcely dehiscing, 1 seeded. Seeds roundish, 3-cornered. Cotyledons incumbent, linear. Racemes opposite the leaves. Flowers white.

1. C. *Ruellii* (*Star of the Earth*). Silicle undivided, crested with little sharp points. Style prominent. Leaves pinnatifid, subdivided. Stem quite prostrate, radiating ——— *Common in waste places.* Flowers white.

CAPSELLA.

Calyx equal at the base. Silicle triangular, wedge-shaped at the base; valves navicular, apterous; cells many-seeded. Racemes terminal. Flowers white.

1. C. *Bursa Pastoris* (*Shepherd's Purse*). An annual. Leaves spreading next the root, variously lobed and cut, tapering to the base, the upper ones sagittate. ——— *Common everywhere in waste places.*

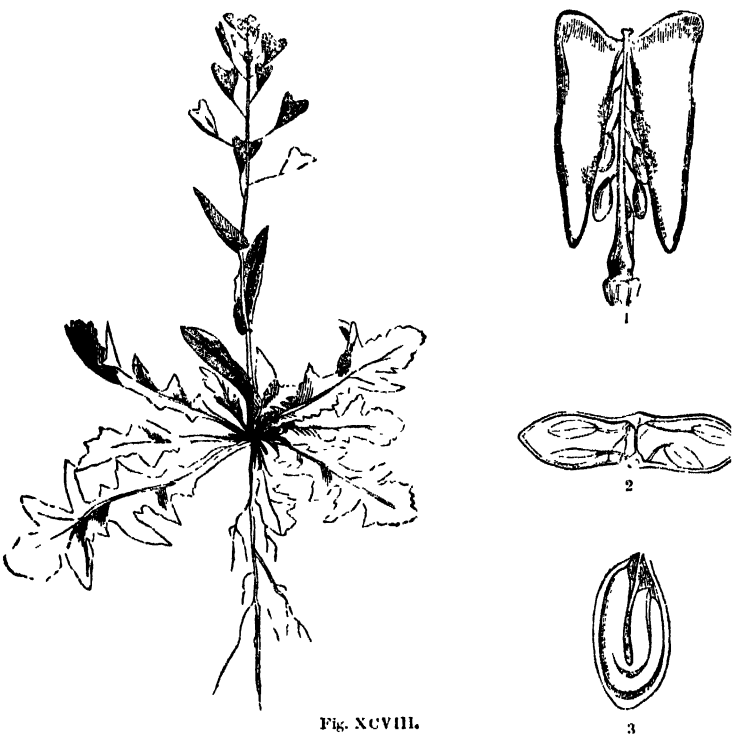


Fig. XCVIII.

Fig XCVIII.—Capsella Bursa Pastoris. 1. Its silicle, in the act of opening; 2. a cross section of it; 3. a section of the seed

IBERIS.

Two exterior petals larger than the others. Silicle much compressed, truncate-emarginate. Seeds ovate, pendulous

1. I. *umbellata* (*Candy Tuft*). An annual herbaceous plant. Leaves lanceolate, acuminate, quite entire except the lower ones, which are slightly toothed. Silicles in close umbellate corymbs, bifid, with the lobes extended into points as long as the cells to which they belong. ——— *Waste places, South of Europe. Common in gardens.*

LEPIDIUM.

Calyx equal at the base. Petals entire. Silicle ovate, or somewhat cordate; valves keeled, or occasionally ventricose, dehiscing; cells 1-seeded. Seeds somewhat triquetrous, or compressed. Racemes terminal. Flowers white.

1. L. *sativum* (*Garden Cress*). An annual. Quite smooth. The leaves variously cut and lobed, the upper quite entire. ——— *Common in gardens.*

EROPHILA.

Calyx equal at the base. Petals 2-lobed. Stamens not toothed. Silicle oval or oblong, with flat valves and a sessile stigma. Seeds numerous, bordered, in two rows. Flowers small, white.

1. E. *vulgaris*. A very small annual. Stem leafless, smooth at the upper part. Radical leaves lanceolate, acute, tapering to the base. ——— *Everywhere on old walls, early in the Spring.*

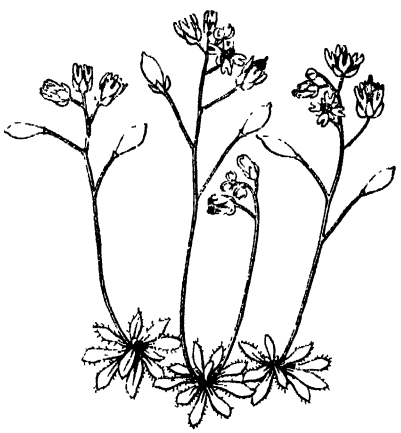


Fig. XCIX.

LUNARIA.

Silicle roundish or oblong, pressed very thin Seeds few, bordered.

1. L. *biennis* (*Honesty*). Silicles broadly oval, rounded at each end. Seeds roundish cordate, as broad as long.—— *In gardens.* A plant found in forests and mountains in Germany. Flowers purple, or white.

§. 3. SILIQUOSÆ. *Fruit a silique, that is, longer than broad.*

SINAPIS.

Calyx spreading Petals obovate. Silique rather taper; valves ribbed. Style small, short, acute. Seeds in one row, roundish. Flowers yellow.

1. S. *arvensis* (*Charlock*). Pods with many angles, rugged, longer than their own awl-shaped beak. Leaves toothed; partly lyrate, or hastate. ——— *Common in corn-fields.*

2. S. *alba* (*White Mustard*). Pods bristly, rugged, spreading, shorter than their own flat two-edged beak. Leaves lyrate. ——— *Gardens and waste places.*

NASTURTIUM.

Calyx spreading, equal. Petals entire. Silique nearly taper, shortened, or declinate. Stigma almost 2-lobed. Seeds small, irregularly attached in two rows, not bordered.

1. N. *officinale* (*Watercress*). Leaves pinnate; leaflets roundish-heart-shaped, ovate, wavy, a little lobed, rather succulent. Flowers white, in short erect racemes. ——— *Common in ditches.*

2. N. *amphibium*. Leaves oblong, pinnatifid or serrated. Roots fibrous. Petals longer than the calyx, yellow. Pod elliptical. ——— *Common in wet places.*

Fig. XCIX.—Erophila vulgaris.

BRASSICA.

Sepals quite erect. Petals obovate. Silique taper, with scarcely any style. Seeds globose, in one row.

1. B. *oleracea* (*Cabbage*). Leaves fleshy, glaucous, waved, lobed, partly lyrate, all quite smooth. Flowers pale yellow. Root fibrous.——— *Common in gardens.*

2. B. *Napus* (*Turnip*). Root globular. Leaves bright green and hairy; upper ones lanceolate, heart-shaped at their base, clasping the stem; lower ones lyrate, toothed. Flowers bright yellow. ——— *Common in fields.*

3. B. *Rapa* (*Rape*). Leaves green the first year, glaucous the second; the lower lyrate, the upper ovate acuminate, deeply heartshaped, stem clasping. Calyx spreading. Root fibrous.——— *In fields.* Of this there is a variety called Colza.

Obs.—The genus Brassica is the parent of a large number of plants in common cultivation. Cabbages, Savoys, Brussels Sprouts, are varieties of B oleracea, with large leaves; when the stem is enlarged into a fleshy turnip-like knob *above the* ground, it forms the Kohl Rabi or Knol Kohl; when the flowers are very imperfect, and crowded together in close heads before expansion, they form what are called Brocoli and Cauliflowers. B. Napus has produced all the turnips except the Swedish, the origin of which is unknown. B. Rapa is chiefly valuable for ploughing in while green and for its seeds, which, under the name of Rape and Colza, are crushed in large quantities for oil, the residue being given to cattle as "Cake" or "Oil Cake."

CARDAMINE.

Calyx equal at the base usually dehiscing with elasticity. Seeds ovate, not bordered; umbilical cords slender. Petals entire. Silique linear; valves flat, nerveless,

1. C. *pratensis*. Leaves pinnate, without stipules; leaflets of the radical ones roundish and toothed; those of the stem-leaves lanceolate entire. Petals with a tooth upon the claw. —— *Meadows and wet ditches. Flowers white or very pale purple.*

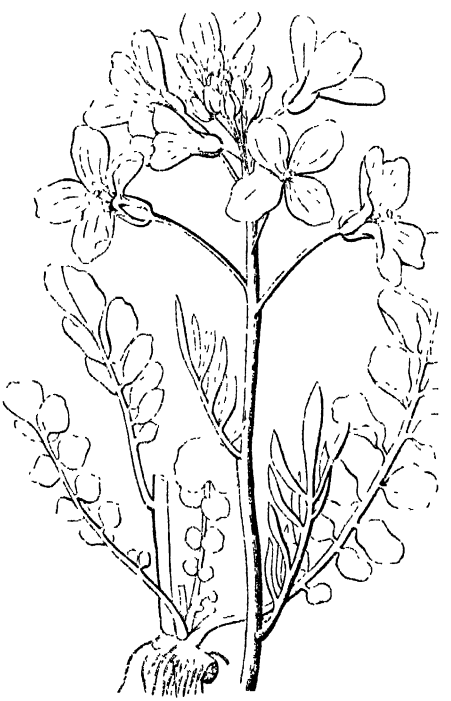


Fig. C.

ARABIS.

Calyx erect. Petals obovate or oblong. Silique linear; valves flat, with a single rib in the middle. Seeds in one row in each cell, oval or orbicular, compressed. Flowers white, unfrequently pink.

1. A. *alpina*. Lower leaves oblong obovate, upper ovate, deeply cordate, amplexicaul. Stems covered with stellate hairs. Flowers large, white. Seeds a little bordered. —— *Gardens, common.*

2. A. *Thaliana*. Leaves hairy, more or less toothed; radical ones stalked, oblong. Stamens not much shorter than the petals. Stem branched. Pod pointing upwards. —— *In fields. An annual. Flowers small, white.*

Fig. C.—Cardamine pratensis.

ALLIARIA.

Calyx equal at the base, lax, deciduous. Four hypogynous glands. Silique nearly taper, somewhat 4-cornered, in consequence of its projecting ribs. Seeds rather cylindrical.

Fig. CI.

1. A. *officinalis* (*Jack by the Hedge*). Leaves cordate. Pods prismatical, much longer than the pedicels.——*Hedgerows. Smells strongly of garlic.*

Calyx with two sacs at the base. Silique taper or compressed. Stigma 2-lobed or capitate. Seeds in one row, ovate, compressed.

1. C. *Cheiri* (*Wallflower*). Leaves lanceolate, acute, with simple close hairs, more hoary beneath. Stem shrubby. Branches angular. Style prominent. ——*Old walls and gardens. Flowers orange-coloured, very fragrant.*

Of this plant there are many varieties, one of which, a kind of shrub, has been called a distinct species, under the name of C. fruticulosus.

ORDER VI. CISTACEÆ—ROCK ROSES.

Essential Character.—*Sepals* 5, persistent, unequal, two external, and sometimes wanting, the three inner with a twisted æstivation. *Petals* 5, hypogynous, very fugitive, crumpled in æstivation, and twisted in a direction contrary to that of the sepals. *Stamens* indefinite, hypogynous, distinct; *anthers* innate. *Ovary* 1- or many-celled; *style* single; *stigma* simple. *Fruit* capsular, usually 3- or 5-valved, occasionally 10-valved, imperfectly 5- or 10-celled, with dissepiments proceeding from the middle of the valves. *Seeds* indefinite in number. *Shrubs* or *herbaceous* plants. *Branches* often viscid. *Leaves* usually entire, opposite or alternate, stipulate or exstipulate. *Racemes* usually unilateral. *Flowers* white, yellow, or red, very fugacious.

*** The plants of this order are more like Papaveraceæ than any others; but they are readily known by their permanent calyx, two of whose sepals are on the outside of the other three, or wholly absent.

CISTUS.

Capsule 5-10-valved, with the valves having the dissepiments in the middle.

1. C. *salvifolius*. Leaves round at the base, ovate, obtuse, rough with hairs, rather hoary underneath. Peduncles solitary, one or two flowered, or somewhat umbellate. Stigma subsessile.——*South of Europe. Gardens.*

2. C. *cyprius* (*Gum Cistus*). Leaves subsessile, connate at the base, linear-lanceolate, smooth and often viscid above, downy beneath. Flowers large, white, with a bright purple spot at the base of each petal.——*South of Europe. Gardens.*

HELIANTHEMUM.

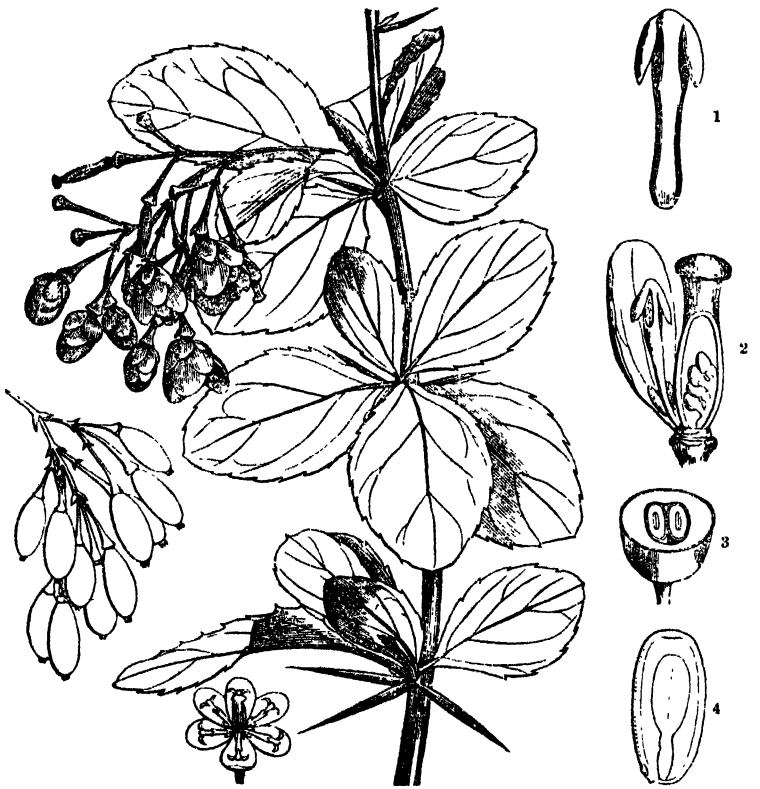
Capsule 3-valved; with only a slight dissepiment in the middle of the valves.

1. H. *vulgare*. A small trailing undershrub. Leaves oval or linear, oblong, ciliated, hairy or downy, revolute at the edge, with stipules. Style 2 or 3 times as long as the ovary. Inner sepals obtuse, mucronulate.——*Chalky downs. Common in gardens.*

Fig. CI.—Alliaria officinalis.

ORDER VII. BERBERIDACEÆ—BERBERRYWORTS.

ESSENTIAL CHARACTER.—*Sepals* 3-4-6, deciduous, in a double row, surrounded externally by petaloid scales. *Petals* either equal to the sepals in number, and opposite to them, or twice as many. *Stamens* equal in number to the petals, and opposite to them; *anthers* generally with two cells, opening with a valve from the bottom to the top. *Ovary* solitary, 1-celled.



Fruit berried or capsular. *Seeds* attached to the bottom of the cell on one side, 1, 2, or more.—*Shrubs*, or *herbaceous perennial* plants, for the most part smooth. *Leaves* alternate, compound, usually without *stipules*.

*** The anthers opening by valves distinguish this order from all others belonging to Europe, except Lauraceæ, which have no petals.

BERBERIS.

Sepals 6. Petals 6, with two glands inside at the base. Berry with two seeds.

1. B. *vulgaris* (*Common Berberry*). A bush with palmate or 3-lobed spines. Leaves fascicled, obovate, with ciliated serratures. Racemes many-flowered, pendulous.

Fig. CII.—Berberis vulgaris. 1. Stamen; 2. perpendicular section of a pistil with one stamen and one petal adhering; 3. cross section of the fruit; 4. perpendicular section of the seed.

Petals yellow, entire, or slightly emarginate. ——— *In hedges and plantations.* Flowers yellow. The wood is hard, and yields a yellow dye.

ORDER VIII. VIOLACEÆ VIOLETWORTS.

ESSENTIAL CHARACTER.—*Sepals* 5, persistent. *Petals* 5, hypogynous, unequal. *Stamens* 5, alternate with the petals, often unequal; *anthers* bilocular, bursting inwards, either separate or cohering, and lying close upon the ovary; *filaments* dilated, elongated beyond the anthers; two generally furnished with an appendage or gland at their base. *Ovary* 1-celled, many-seeded, with 3 parietal placentæ; *style* single, usually declinate, with an oblique hooded *stigma*. *Capsule* of 3 valves, bearing the placentæ in their axis.——*Herbaceous* plants. *Leaves* simple, alternate, stipulate.

*** The permanent calyx, irregular flowers, and anthers, and 3 parietal placentæ in the middle of the same number of valves, readily distinguish this order among European plants.

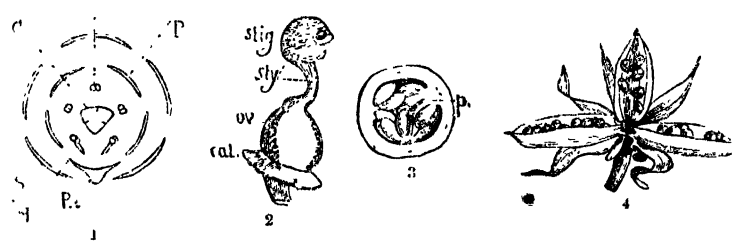
Sepals unequal, auricled. Petals unequal, the lower spurred. Stamens on the apex of a 5-toothed disk; two lower anthers with processes at their back. Capsule 3-valved, opening with elasticity.

Fig. CIII.

1. V. *canina* (*Dog Violet*). Stem at length ascending, channelled. Leaves oblong, heart-shaped. Calyx acute. Stipules serrated. Bracts awl-shaped, entire. Flowers scentless.—— *Groves, woods, and hedgerows.*

2. V. *odorata* (*Sweet Violet*). Stem none, producing runners. Leaves heart-shaped, nearly smooth, as well as their footstalks Sepals obtuse. Lateral petals with a hairy central line. Flowers sweet-scented —*Groves, woods, and hedgerows.*

3. V. *tricolor* (*Heart's-ease, or Pansy*). Stem angular, diffuse, divided. Leaves oblong, deeply crenate. Stipules lyrate, pinnatifid. Bracts obsolete.—*Corn fields.*



ORDER IX. DROSERACEÆ—SUNDEWS.

ESSENTIAL CHARACTER.—*Sepals* 5, persistent, equal. *Petals* 5, hypogynous. *Stamens* distinct, withering, equal in number to the petals and

Fig. CIII.—Viola tricolor. 1. Diagram of the flower; *s*, sepals; *p*, petals; *e*, stamens; *c*, carpels; 2. Pistil; 3. Transverse section of the ovary; 4. Fruit ripe and split into 3 valves.

alternate with them. *Ovary* single ; *styles* 3-5. *Capsule* of 3 or 5 valves, which bear the placentæ in the middle.—Small *herbaceous* plants, often covered with glands. *Leaves* alternate, with *stipulary* fringes and a circinate vernation. *Peduncles*, when young, circinate.

*** When the young leaves and flower stems first begin to grow in the spring, they are curled inwards like the head of a pastoral crook : a mark by which this order may be always known. Afterwards, they are liable to be confounded with Violaceæ, because of their 5 hypogynous stamens, and 3 parietal placentæ ; they are, however, distinctly separated from that order by their regular flowers, disunited stamens, and anthers not extended at the end into a crested appendage.

Sepals and petals 5, without appendages. Stamens 5. Styles 3-5, divided in two. Glandular herbaceous plants.

1. D. *rotundifolia* (*Sundew*) Leaves fringed with long red glandular hairs, depressed, growing in a circle, nearly orbicular, on hairy foot-stalks. Flower-stalks radical, racemose. Flowers white.— *Bogs.*

ORDER X. POLYGALACEÆ—MILKWORTS.

Essential Character.—*Sepals* 5, very irregular, distinct, 2 interior (*the wings*) petaloid. *Petals* hypogynous, 3 ; of which one is anterior and larger than the rest (*the keel*), and 2 alternate with the upper outer, and lateral inner sepals, and often connate with the keel. *Keel* sometimes entire, and then either naked or crested ; sometimes 3-lobed, and then destitute of a crest. *Stamens* hypogynous, 8, usually combined in a tube, unequal, and ascending ; *anthers* 1-celled and opening at their apex. *Ovary* superior, compressed, with 2 or 3 cells, which are anterior and posterior, the upper one occasionally suppressed ; *ovules* solitary, very rarely twin.

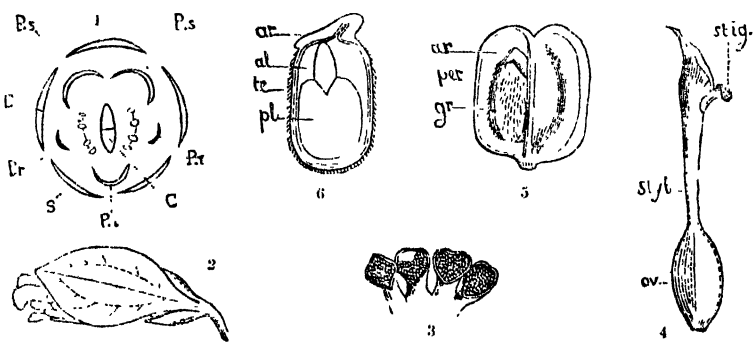


Fig. CIV.

pendulous ; *style* simple, curved, sometimes very oblique and cucullate at the apex, which is also entire or lobed ; *stigma* simple. *Fruit* usually opening through the valves ; occasionally indehiscent. *Seeds* pendulous,

Fig. CIV.—Polygala vulgaris. 1. A diagram, showing the relative position of the parts ; *s*. sepals, *p*, petals, *c*, stamens, *r*, carpels ; 2. a side view of a flower : 3 anthers ; 4 pistil ; 5. fruit, with one cell laid open ; *per*. pericarp ; *ar*. aril ; *gr*. seed ; 6. seed ; *ar*. aril ; *al*. albumen ; *te*. testa : *pl*. embryo.

with a caruncula next the hilum. —— *Shrubs* or *herbaceous* plants. *Leaves* generally alternate, sometimes opposite, mostly simple, and always destitute of *stipules*. *Flowers* usually racemose, very often small and inconspicuous, but showy in many Polygalas. *Pedicels* with 3 bracts.

*** The student must be careful not to mistake a Polygala for a Fabaceous or Leguminous plant, because of its having two wings to the flower. In Polygalaceæ, the wings belong to the calyx, in Fabaceæ to the corolla.

POLYGALA.

Sepals persistent, the two inner wing-shaped. — Petals 3-5, adhering to the tube of the stamens; the lower carinate. Capsule compressed, elliptical, obovate, or obcordate. Seeds downy.

1. P. *vulgaris* (*Milkwort*). Flowers crested. Bracts 3, at the base of each flower-stalk, deciduous. Wings about equal to the corolla. Stems ascending, simple, herbaceous. Leaves linear-lanceolate. — *Chalky downs and on heaths. Very bitter.*

Fig. CV.—Polygala vulgaris

ORDER XI. CARYOPHYLLACEÆ—SILENADS.

ESSENTIAL CHARACTER.—*Sepals* 5, tubular or disunited. *Petals* 5, entire or slit. *Stamens* twice as many as the petals, but some often imperfect; hypogynous. *Ovary* 1-celled, with a free central placenta, bearing many ovules. *Styles* several, fruit 1-celled, capsular, in most cases opening by teeth or valves. —— *Herbaceous* plants, with opposite narrow entire leaves and tumid nodes.

*** There are no other Exogens with polypetalous flowers, opposite undivided leaves without stipules, and stems tumid at the nodes.

§ 1. Sileneæ. *Calyx tubular.*

LYCHNIS.

Calyx tubular, 5-toothed, naked. Petals 5, unguiculate, usually with scales at the throat. Stamens 10. Stigmas 5. Capsule 1-5 celled.

1. L. *Flos Cuculi* (*Ragged Robin*). Leaves linear-lanceolate. Petals in four linear segments. Capsule roundish, of one cell. Stem rough with deflexed bristles.——*Common by waysides.*

2 L. *dioica* (*Bachelor's Buttons.*) Petals ½ bifid, with an appendage. Stem villous beneath. Upper leaves ovate-lanceolate, tapering to a point, with the peduncles and calyx covered with glandular hairs. Flowers diœcious. —— *Common by roadsides. Flowers white, opening in the evening, sweet-scented, or purple, open all day long, and scentless.*

Fig. CVI.

DIANTHUS.

Calyx tubular, 5-toothed, with from 2 to 4 opposite imbricated bracts at the base. Petals 5, with long claws. Stamens 10. Stigmas 2. Capsule 1-celled. Seeds compressed, convex on one side, concave on the other, peltate. Embryo nearly straight.

1. D. *barbatus* (*Sweet William*). Flowers in heads. Bracts herbaceous, ovate, with a subulate awn as long as the calyx, the outermost reflexed. Leaves lanceolate, on short stalks.——*Gardens. Alps of Europe.*

2. D. *Caryophyllus* (*Common Pink*). Flowers very sweet-scented, solitary. Bracts almost rhomboid, very short. Petals notched, beardless. Leaves very glaucous, smooth at the edge, scabrous at the base.—— *Old walls. Common in gardens.*

SILENE.

Calyx tubular, 5-toothed, naked. Petals 5, unguiculate, generally having scales at the throat, with a bifid limb. Stamens 10. Stigmas 3. Capsules 3-celled at the base, dehiscing at the apex with 6 teeth.

Fig CVI.—Lychnis dioica. 1. Vertical section of young flower; 2. of young pistil; 3. of seed; *te.* testa, *alb.* albumen, *cot.* cotyledons.

1. S. *Armeria* (*Lobel's Catchfly*). Flowers aggregate, tufted. Bracts lanceolate, downy, as long as the calyx. Petals serrated. Leaves very narrow, rather blunt.——*A common annual in gardens.*

§ 2. Alsineæ. *Calyx divided into five leaves.*

ARENARIA.

Sepals 5. Petals 5, entire. Stamens 10, some of which are occasionally abortive. Stigmas 3. Capsule 1-celled, with 3 or 6 teeth at the apex, and many seeds.

1. A. *serpyllifolia*. Leaves ovate, nearly sessile, rough. Sepals hairy; three outermost 5-ribbed, half as long again as the corolla. Petals oval.——*Fields, old walls, and barren places.*

ALSINE.

Sepals 5, rarely 4. Petals 5, rarely 4, entire, or slightly emarginate. Stamens 10, or fewer; all the filaments subulate. Ovary with many ovules. Styles 3. Capsule 3-valved.

1. A. *rubra*. Leaves linear-filiform, mucronate, somewhat fleshy, flat on each side, with stipules. Stems prostrate and ascending, branched. Branches racemose. Peduncles bent back after flowering. Sepals lanceolate, obtuse, nerveless, membranous at the edge. Seeds wingless.—— *Waste gravelly places.*

CERASTIUM.

Calyx 5-parted. Petals 5, bifid. Stamens 10. Stigmas 5. Capsule 1-celled, cylindrical or globose, with 10 teeth at the point.

1. C. *vulgatum*. Hairy, pale green. Leaves roundish-ovate, very blunt. Flowers in dense dichotomous panicles. Petals linear, with two teeth, scarcely longer than the calyx. Capsules ascending, oblong, about twice as long as the calyx; with subulate teeth.——*A common weed.*

STELLARIA.

Calyx 5-parted. Petals 5, bifid. Stamens 10, or by abortion 3-8. Stigmas 3. Capsule of one cell, 6 teeth at the apex, and many seeds.

1. S. *nemorum*. Lower leaves heart-shaped, stalked; upper ovate, sessile. Panicle repeatedly forked Stem ascending, villous upwards.——*Shady woods and damp places.*

2. S. *media* (*Chickweed*). Leaves ovate, the upper sessile. Stems procumbent, with a hairy alternate line on one side. Stamens from 3 to 10. Petals as long as the calyx, or shorter.——*Everywhere, in waste places.*

3. S. *graminea*. Leaves linear-lanceolate, entire, ciliated at the base. Panicle terminal, spreading. Sepals 3-ribbed, nearly as long as the petals. Stem quadrangular, smooth. Capsule oblong.——*Damp ditches, common.*

4. S. *Holostea*. Leaves lanceolate, taper pointed, finely serrated. Petals inversely heart-shaped. Sepals without ribs. Stem quadrangular. Capsule globose.——*Damp ditches.*

SPERGULA.

Calyx 5-parted. Petals 5, entire. Stamens 5-10. Stigmas 5. Capsule of one cell, 6 valves, and many seeds.

1. S. *arvensis* (*Spurrey*). Leaves whorled, linear-subulate. Stalks, when in fruit, reflexed. Seeds globose, roughish, with a narrow wing.——*Corn fields.*

ORDER XII. TILIACEÆ—LINDENBLOOMS, OR TILIADS.

Essential Character.—*Sepals* 4 or 5, with a valvular æstivation. *Petals* 4 or 5, entire. *Stamens* indefinite, hypogynous, distinct; *anthers*

2-celled, dehiscing longitudinally. *Ovary* single, composed of from 4 to 10 carpels; *style* one; *stigmas* as many as the carpels. *Fruit* dry, of several cells.—*Trees* or *shrubs*. *Leaves* simple, stipulate, toothed, alternate. *Flowers axillary*.

*** The valvate restivation of the calyx brings these plants near Malvaceæ, from which they are immediately known by their stamens being distinct, with 2 celled anthers.

TILIA.

Calyx 5-parted, deciduous. Petals 5, with or without a scale on the inside. Stamens numerous, with distinct or somewhat polyadelphous filaments Ovarium with one style, and 5 2-seeded cells. Fruit, by abortion, 1-celled, with 1 or 2 seeds.—Trees, with a bark separating into distinct layers; and light wood.

1. T. *europæa* (*Lime Tree*). Leaves twice the length of the foot-stalks, quite smooth, except a woolly tuft at the origin of each vein beneath. Cymes many-flowered. Fruit coriaceous, downy. ——— *A common tree in woods*. Flowers yellowish, sweet-scented.

2. T. *parvifolia*. Leaves smooth above, glaucous beneath, with scattered as well as axillary hairy blotches. Umbels compound, many-flowered. Fruit roundish, brittle, nearly smooth. ——— *A tree common in woods*. Flowers yellowish, very sweet.*

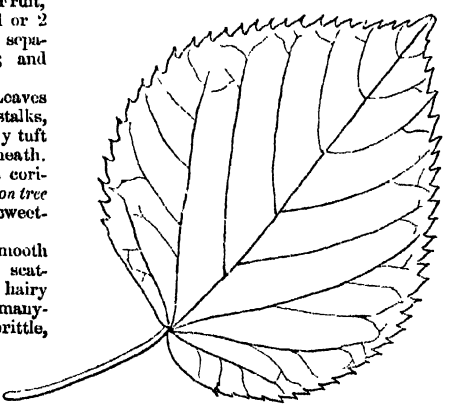


Fig. CVII.

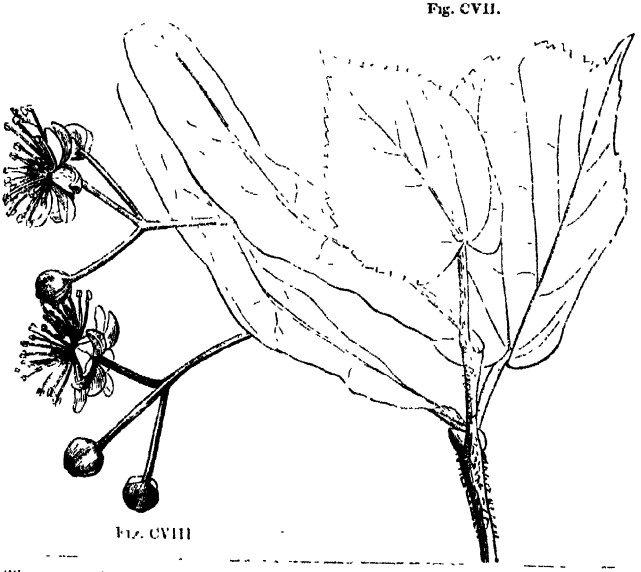


Fig. CVIII

* These two trees, especially the first, grow quickly in dry land, form very ornamental trees, and are the favourite resort of bees. Their wood is soft, light, and colourless, and chiefly used by turners.

Fig. CVII.—Tilia europæa; a single leaf
Fig. CVIII. Do., a branch in flower, with the peculiar bracts

ORDER XIII. HYPERICACEÆ.—TUTSANS.

ESSENTIAL CHARACTER.—*Sepals* 4-5, distinct, persistent, unequal, with glandular dots. *Petals* 4-5, very unequal sided, hypogynous, with a twisted æstivation and often having black dots. *Stamens* indefinite, hypogynous, in three or more parcels; *anthers* versatile. *Ovary* single, superior; *placenta* at this time central; *styles* several, rarely connate; *stigmas* simple, occasionally capitate. *Fruit* a capsule or berry, of many valves and many cells; the edges of the former being curved inwards.—*Herbaceous* plants, *shrubs*, or *trees*, with a resinous juice. *Leaves* opposite, entire, sometimes dotted, occasionally alternate and crenelled. *Flowers* generally yellow. *Inflorescence* variable.

*** The polyadelphous stamens and unequal sided dotted petals mark this order.

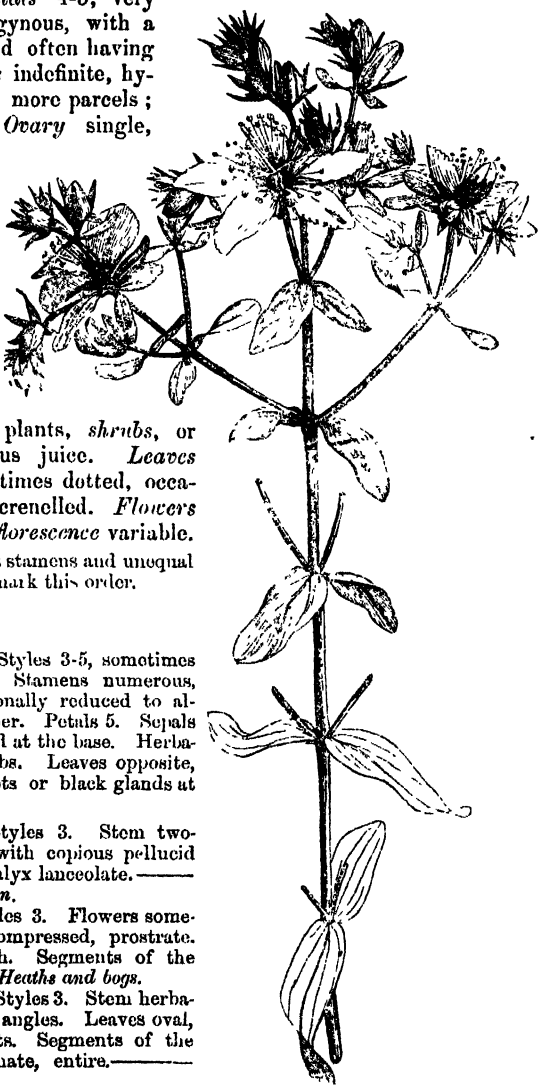


Fig. CIX.

Capsule membranous. Styles 3-5, sometimes variable in number. Stamens numerous, polyadelphous, occasionally reduced to almost a definite number. Petals 5. Sepals 5, more or less united at the base. Herbaceous plants or shrubs. Leaves opposite, often with pellucid dots or black glands at the margin.

1. H. *perforatum*. Styles 3. Stem two-edged. Leaves obtuse, with copious pellucid dots. Segments of the calyx lanceolate.——*Woods and hedges, common.*

2. H. *humifusum*. Styles 3. Flowers somewhat cymose. Stem compressed, prostrate. Leaves elliptical, smooth. Segments of the calyx ovate, leafy.——*Heaths and bogs.*

3. H. *quadrangulare*. Styles 3. Stem herbaceous, with four winged angles. Leaves oval, with copious pellucid dots. Segments of the calyx lanceolate acuminate, entire.——*Ditches and wet places.*

4. H. *pulchrum*. Styles 3. Calyx ovate, with glandular serratures. Stem erect, round. Leaves clasping the stem, heart-shaped, smooth.——*Woods and heaths.*

Fig CIX.—Hypericum perforatum.

ORDER XIV. MALVACEÆ—MALLOWWORTS, OR MALVADS.

ESSENTIAL CHARACTER.—*Sepals* 5, valvate, often bearing external bracts forming an involucel. *Petals* twisted. *Stamens* indefinite, hypogynous: *filaments* in a long column; *anthers* 1-celled. *Carpels* sometimes united, sometimes separate or separable. ——*Herbaceous* plants, or *shrubs*. *Leaves* alternate, stipulate. *Hairs* stellate.

*** The valvate calyx, and columnar stamens, afford a certain characteristic of this order.

Fig. CIX *b*.

MALVA

Involucel formed of 3 leaves, seldom of 5 or 6. Achænia numerous, arranged in a circle round a convex centre.

1. M. *sylvestris* (*Common Mallow*). Stem upright, herbaceous. Leaves with 7 acute lobes. Foot-stalks and flower-stalks hairy.—— ——*Waysides*. Flowers large, purple, striped. Fruit called "cheeses" by country people.

ALTHÆA

Involucel having from 6 to 9 divisions. Achænia as in Malva.

1. A. *officinalis* (*Marsh Mallow*). Leaves simple, very soft and downy, cordate or ovate, the lower 5-lobed, the upper 3-lobed.——*Meadows*. Stem 3 or 4 feet high. Flowers very pale lilac. All the parts mucilaginous; used as a poultice.

Fig. CIX. *c*

ORDER XV. LINACEÆ.—FLAXWORTS.

ESSENTIAL CHARACTER.—*Sepals* 5, imbricated. *Petals* 5, unguiculate, twisted. *Stamens* 5, alternate with the petals, united into a hypogynous ring. *Ovary* 5-celled; *styles* 5; *stigmas* capitate. *Capsule* generally pointed with the base of the styles, many-celled; cells partially divided by a spurious dissepiment. *Seeds*

Fig. CIX. *b*.—Malva sylvestris; 1, section of a flower; 2, a fruit.
Fig. CIX. *c*.—Linum usitatissimum.

in each cell single, compressed, inverted.—*Herbaceous* plants, or small *shrubs*. *Leaves* entire, without stipules, usually alternate. *Petals* fugitive.

LINUM.

Parts of the flower quinary. Sepals entire. Styles very seldom 3.

1. L. *usitatissimum* (*Common Flax*). Sepals ovate, acute, ciliated, not glandular, as long as the calyx. Petals crenate, blue. Leaves lanceolate, alternate Stems mostly solitary, quite erect.——*Common cultivated*. Flowers large, blue, with very deciduous petals. An annual. This is the plant the fibre of whose stems is manufactured into the finer kinds of linen.

2. L. *perenne*. Sepals ovate, smooth, not glandular, shorter than the calyx, the inner very obtuse. Leaves linear-lanceolate, smooth. Stems numerous. Stalks of the fruit quite erect.——*Germany*. Flowers large, blue, with very deciduous petals. A perennial.

ORDER XVI. ACERACEÆ—MAPLES.

ESSENTIAL CHARACTER.—*Calyx* divided into 5, or occasionally from 4 to 9 parts, with an imbricated æstivation. *Petals* equal in number to the lobes of the calyx, inserted round a hypogynous disk. *Stamens* inserted upon a hypogynous disk, generally 8. *Ovary* 2-lobed; *style* 1; *stigmas* 2. *Fruit* formed of two parts, which are indehiscent and samaroid; each 1-celled, with 1 or 2 seeds.—*Trees*. *Leaves* opposite, simple, rarely pinnate, without stipules. *Flowers* often polygamous, sometimes apetalous, in axillary corymbs or racemes.

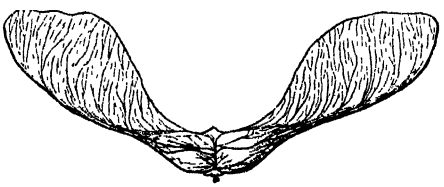


Fig. CX.

ACER.

Flowers polygamous. Calyx of 5 lobes or parts. Stamens seldom 5, generally 7 or 9. Leaves simple.

1. A. *Pseudoplatanus* (*The Sycamore Tree*). Leaves palmate, 5-lobed, glaucous beneath, unequally serrated, with acuminate lobes. Racemes long, pendulous.——*Woods*. A large tree with soft white wood, of no use except for the turners, who make wooden bowls, and similar utensils from it.

2. A. *campestre* (*The Maple Tree*). Leaves palmate, 5-lobed, obtuse, somewhat cut. Corymbs erect.——*Woods and hedges*. A small tree, or bush, often with corky bark. Its wood is harder and heavier than that of the last, but of small scantling.

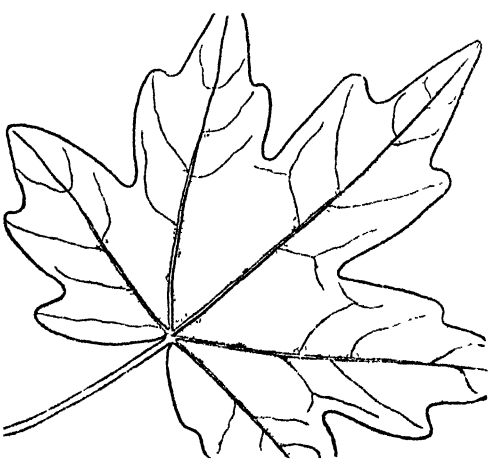


Fig. CXI.

Fig. CX.—Samara of Acer Pseudoplatanus. Fig. CXI.—Under-side of leaf of Acer Campestre.

ORDER XVII. GERANIACEÆ—CRANESBILLS.

ESSENTIAL CHARACTER.—*Sepals* 5, persistent, ribbed, with an imbricated æstivation. *Petals* 5, hypogynous. *Stamens* usually monadelphous, hypogynous, twice or thrice as many as the petals. *Ovary* composed of 5 pieces placed round an elevated axis, each 1-celled, 1-seeded; *styles* 5, cohering round the elongated axis. *Fruit* formed of 5 pieces, cohering round a lengthened indurated axis; each piece consisting of 1 cell, containing 1 seed, having a membranous pericarp, and terminated by an indurated style, which finally curls back from the base upwards, carrying the pericarp along with it. *Seeds* solitary, pendulous.—*Herbaceous* plants or *shrubs*. *Stems*

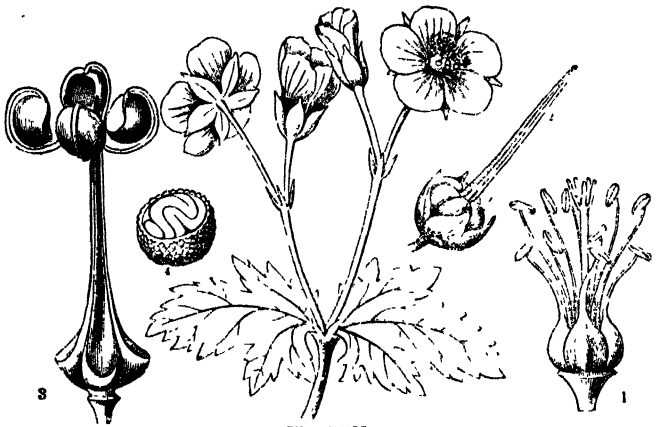


Fig. CXII.

tumid, and separable at the joints. *Leaves* either opposite or alternate; in the latter case opposite the peduncles; often stipulate.

*** The long beak to the fruit is a peculiar feature of the plants of this order.

GERANIUM.

Sepals 5, equal. Petals 5, equal. Stamens 10, fertile, alternately larger. Nectariferous glands at the base of the larger stamens. Indurated styles glabrous internally, curling back at the axis, from the base to the point. Herbaceous plants with palmate-lobed leaves, and 1- or 2-flowered peduncles.

1. G. *pyrenaicum*. Stalks 2-flowered. Petals twice the length of the calyx. Leaves kidney-shaped, lobed. Fruits keeled, even, somewhat downy. Seeds without dots. ——— *Meadows, common in many places*. Flowers small, purple.

2. G. *dissectum*. Stalks 2-flowered. Petals cloven, shorter than the sepals. Leaves in 5 deep laciniated segments. Fruit hairy. Seeds reticulated. ——— *Fields and hedge-rows, common*. Flowers pale purple.

3. G. *molle*. Stalks 2-flowered, alternate, opposite to the leaves, which are rounded, many-lobed, notched, and downy. Petals emarginate. Fruit much wrinkled, smooth. Seeds without dots. ——— *Waste places, common*. Flowers small, purple.

4. G. *rotundifolium*. Stalks 2 flowered. Petals entire. Leaves kidney-shaped, cut, downy. Fruit even, hairy. Seeds reticulated. ——— *Waste places*.

5. G. *lucidum*. Stalks 2-flowered. Leaves 5-lobed, rounded. Calyx pyramidal, transversely wrinkled. Fruit wrinkled, triply keeled. ——— *Rocks and walls*. Leaves and stems very shining, usually stained bright red

6. G. *Robertianum* (*Herb Robert*). Stalks 2-flowered. Leaves somewhat pedate, pinnatifid, 5-angled. Calyx with 10 angles. Fruit wrinkled, simply keeled. ——— *Hedgerows, fields, and waste places*. Whole plant, with a strong disagreeable smell.

Fig. CXII.—Geranium sylvaticum. 1. The stamens and style. 2. The unripe fruit surrounded by a calyx. 3. The beaked axis (or torus), from which the carpels are rolling back with elasticity; one has dropped off. 4. A transverse section of a seed.

ERODIUM.

Sepals 5, equal, not extended into a nectariferous tube. Petals 5, regular or irregular. Stamens 10, monadelphous, of which 5 are sterile. Glands at the base of the sterile stamens. Styles indurated, bearded internally, twisted spirally when ripe.—Herbaceous plants or undershrubs, with lobed leaves, and peduncles usually bearing several flowers.

1. *E. cicutarium.* Stems procumbent, hairy. Stalks many-flowered. Leaves pinnate; leaflets sessile, pinnatifid, cut. Stamens simple. ——— *Waste places.* A common annual.

The common cultivated greenhouse "Geraniums," as they are called, are principally from the Cape of Good Hope, and belong to the genus Pelargonium, which is botanically known by having 7 stamens, the flowers very irregular in form, and one of the sepals extended into a nectariferous tube.

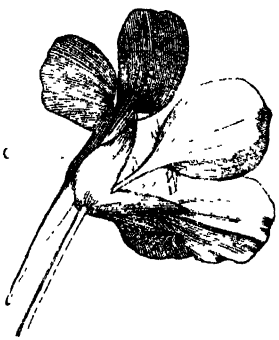


Fig. CXIII.

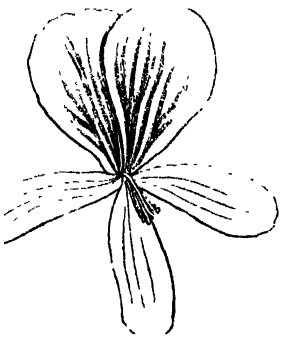


Fig. CXIV.

Nearly allied to Geraniaceæ is the common genus Nasturtium, or Indian Cress, called Botanically Tropæolum majus. It forms part of an Order named Tropæolaceæ, and is known from Geraniaceæ by having a long spur to its calyx, whose æstivation is valvate, and a 3-lobed fleshy fruit without a beak. The half ripe fruit is gathered by housekeepers and boiled in vinegar as a substitute for capers.

ORDER XVIII. OXALIDACEÆ—OXALIS.

Essential Character.—*Sepals* 5, sometimes slightly cohering at the base, persistent, equal. *Petals* 5, hypogynous, equal, unguiculate, with a spirally-twisted æstivation. *Stamens* 10, usually more or less monadelphous, those opposite the petals forming an inner series, and longer than the others; *anthers* 2-celled, innate. *Ovary* with 5 angles and 5 cells; *styles* 5, filiform; *stigmas* capitate or somewhat bifid. *Fruit* capsular, membranous, with 5 cells, and from 5 to 10 valves. *Seeds* few, fixed to the axis, enclosed within a fleshy integument, which curls back at the maturity of the fruit, and expels the seeds with elasticity.—*Herbaceous* plants, *undershrubs*, or *trees*. *Leaves* alternate, compound, sometimes simple by abortion, very seldom opposite or somewhat whorled.

OXALIS.

Sepals 5, distinct, or united at the base. Petals 5. Stamens 10; filaments slightly monadelphous; the 5 exterior alternately shorter. Styles 5. Stigmas pencilled or capitate. Capsule 5-cornered, oblong or cylindrical.

1. *O. Acetosella* (*Wood Sorrel*). Stalks radical, single-flowered. Leaves ternate, inversely heart-shaped, hairy. Root of many scaly joints. Stamens all simple.—*Woods.* Flowers small, whitish, with pale purple veins. Leaves acid, a little sensitive in the sunshine. This is believed to be the genuine "*Shamrock*" of the Irish.

Fig. CXIII.—Flower of Tropæolum majus; *c* the calcarate or spurred sepal.
Fig. CXIV.—Flower of a Pelargonium.

ORDER XIX. RUTACEÆ.—RUEWORTS.

ESSENTIAL CHARACTER.—*Flowers* hermaphrodite, regular or irregular. *Calyx* in 4 or 5 divisions. *Petals* as many as the divisions of the calyx. *Stamens* equal in number to the petals, or twice or thrice as many, or even fewer, hypogynous, placed on the outside of a disk or cup surrounding the ovary. *Ovary* sessile or stalked, its lobes equal to the number of petals, or fewer; *ovules* twin and collateral, or one above the other; *style* single; *stigma* simple or dilated. *Fruit* consisting of several carpels, either cohering firmly or more or less distinct. *Seeds* twin or solitary, with a testaceous integument.—*Trees*, *shrubs*, or *herbaceous* plants. *Leaves* without stipules, opposite or alternate, simple or pinnated, filled with transparent dots.

RUTA.

Calyx permanent, usually 4-parted. Petals usually 4, unguiculate, concave. Stamens 8, straight, inserted on a disk below the ovary. As many honey-pores as there are stamens. Ovary 4-lobed.

1. R. *graveolens* (*Ru*). Leaves usually tripinnate, with oval and obovate leaflets Petals toothed. Lobes of the capsule blunt. ——— *Common in gardens.* Whole plant with a strong oppressive smell. Flowers dingy greenish yellow.

DICTAMNUS.

Calyx deciduous, 5-parted. Petals 5, unguiculate, rather unequal. Stamens 10, declinate. Ovary raised upon a short disk.

1. D. *Fraxinella* (*Fraxinella*). Leaves pinnated; leaflets oblong, serrated. Petals acute, veiny. ——— *Swiss mountains. Common in gardens.* Whole plant very fragrant. Flowers white or purple. It is said that the atmosphere surrounding this plant is in hot dry weather inflammable.

In addition to the preceding orders are the following, which are of much less importance, but which contain European species, or such as are very commonly cultivated.

CAPPARIDACEÆ.—CAPPARIDS.

ESSENTIAL CHARACTER.—*Sepals* 4, either nearly distinct, or cohering in a tube. *Petals* 4, cruciate. *Stamen* almost perigynous, indefinite. *Disk* hemispherical, or elongated, often bearing glands. *Ovary* stalked; *style* none, or filiform. *Fruit* either podshaped and dehiscent, or baccate, 1-celled, with 2 polyspermous placentæ. *Seeds* generally uniform, without albumen.—*Herbaceous* plants, *shrubs*, or *trees*, without true stipules, but sometimes with spines in their place. *Leaves* alternate, stalked, undivided, or palmate.

*** *Capparis spinosa* (*the common Caper*), a plant inhabiting rocky places in the South of Europe, is the only European species of this order, which is chiefly tropical.

FRANKENIACEÆ.—FRANKENIADS.

ESSENTIAL CHARACTER.—*Sepals* 4-5, in a furrowed tube. *Petals* hypogynous, unguiculate. *Stamens* hypogynous, either equal in number to the petals, or having a tendency to double the number; *anthers* roundish, versatile. *Ovary* superior; *style* filiform, 2-fid or 3-fid. *Capsule* 1-celled, enclosed in the calyx, 2- 3- or 4-valved, many-seeded. *Seeds* attached to the margins of the valves, very minute.—*Herbaceous* plants or *under-shrubs*.

Leaves opposite, exstipulate, with a membranous sheathing base. *Flowers* sessile in the divisions of the branches, usually pink.

*** Little obscure plants, usually inhabiting the neighbourhood of the sea, and of no importance to man.

TAMARICACEÆ.—TAMARISKS.

ESSENTIAL CHARACTER.—*Calyx* 4- or 5-parted, persistent, with an imbricated æstivation. *Petals* withering, imbricated. *Stamens* equal to the petals in number, or twice as many, distinct or monadelphous. *Ovary* superior; *style* very short; *stigmas* 3. *Capsule* 3-valved, 1-celled, many-seeded; *placentæ* 3, either at the base of the cavity, or along the middle of the valves. *Seeds* erect or ascending, shaggy.—*Shrubs* or *herbs*, with rod-like branches. *Leaves* alternate, resembling scales, entire. *Flowers* in close spikes or racemes.

*** *Tamarix gallica* (the *French Tamarisk*) and *Myricaria germanica* (the *German Tamarisk*) are commonly cultivated as shrubs. The former becomes a tree in warmer latitudes, and in the East exudes a kind of manna: the latter has been found wild in England.

ELATINACLÆ—WATER PEPPERS.

ESSENTIAL CHARACTER.—*Sepals* 3-5, distinct, or slightly connate. *Petals* alternate with the sepals. *Stamens* usually twice as numerous as the petals. *Ovary* with from 3 to 5 cells, an equal number of styles, and capitate stigmas. *Fruit* capsular, 3-5-celled, with the valves alternate with the septa. *Seeds* numerous.—*Annuals*, found in marshy places. *Stems* fistular, rooting. *Leaves* opposite, with stipules.

*** Minute weeds, of rare occurrence, and of no importance.

ZYGOPHYLLACEÆ.—BEAN CAPERS.

ESSENTIAL CHARACTER.—*Flowers* hermaphrodite, regular. *Calyx* of 4 or 5 pieces, convolute. *Petals* unguiculate. *Stamens* double the number of the petals, dilated at the base, sometimes placed on the back of a small scale. *Ovary* surrounded at the base with glands, or a short sinuous disk, more or less furrowed, with 4 or 5 cells; *ovules* in each cell 2 or more; *style* simple, usually with 4 or 5 furrows; *stigma* simple, or with 4 or 5 lobes. *Fruit* capsular, rarely somewhat fleshy, with 4 or 5 angles or wings. —*Herbaceous* plants, *shrubs*, or *trees*, with membranous stipules between the opposite leaves. The branches are usually, when young, separable at the articulations.

*** A few species occur in the south-eastern parts of Europe; *Fagonia cretica* and *Zygophyllum Fabago* may be taken as types of the order, which approaches very nearly to Rutaceæ, differing in the leaves being opposite and having stipules, and in their not being dotted.

CORIARIACEÆ.

ESSENTIAL CHARACTER.—*Flowers* hermaphrodite, or unisexual. *Calyx* campanulate, 5-parted. *Petals* 4, fleshy, with an elevated keel in the inside. *Stamens* 10, arising from the torus, 5 between the lobes of the calyx and the angles of the ovary, 5 between the petals and the furrows of the ovary. *Ovary* seated on a thickish base, 5-celled, 5-angled; *stigmas* 5, long, subulate; carpels 5, when ripe close together but separate, indehiscent, 1-seeded.

—*Shrubs*, with opposite branches. *Leaves* opposite or alternate, simple, entire. *Buds* scaly. *Racemes* terminal, and axillary.

*** One plant only, *Coriaria myrtifolia*, a Spanish species, is found in Europe. It is a common shrub in curious collections.

AURANTIACEÆ.—CITRONWORTS.

ESSENTIAL CHARACTER.—*Calyx* short, with shallow teeth. *Petals* 5, hypogynous, imbricated. *Stamens* several, separate or monadelphous, placed on the outside of a fleshy disk. *Ovary* undivided, many-celled, with a few ovules in each cell adhering to the axis; *style* 1; *stigma* simple. *Fruit* pulpy, with a tough rind.—*Trees*, with very fragrant dotted leaves, which are jointed with their stalk. *Flowers* white, extremely fragrant.

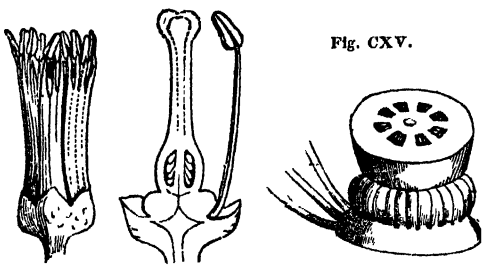


Fig. CXV.

*** The genus Citrus, which is the commonest of this order, contains the Lemon, Sweet Orange, Seville Orange, Shaddock, and similar fruits. Although they are now so common in Europe, being cultivated in all the southern climates, and very generally in greenhouses in this country, yet they are really of Asiatic origin, growing wild in the temperate parts of India and China, where they have been dispersed by the agency of man.

Aurantiaceæ are very near Rutaceæ, from which they are known by their unlobed ovary, and succulent fruit.

Fig. CXVI.

Fig. CXV.—The Orange tree. 1, The flower without its corolla: 2, a vertical section of the ovary, showing the portion of the disk and stamens; 3, a transverse section of the same, much more enlarged.

Fig. CXVI.—Citrus Aurantium.

CHAPTER V.

OF CALYCIFLORAL EXOGENS.

THERE are the following principal natural orders of this subclass in the Flora of Europe; namely,—

Celastraceæ; Rhamnaceæ; Leguminosæ, or Fabaceæ; Rosaceæ; Onagraceæ; Lythraceæ; Myrtaceæ; Crassulaceæ; Grossulariaceæ; Saxifragaceæ; Umbelliferæ, or Apiaceæ.

Their differences are briefly expressed in the following characters:—

Celastraceæ.—Sepals imbricate, with the petals and stamens 4 or 5 each; the latter alternate with the petals. Disk large and fleshy. Carpels united into a superior 3 or 4 celled pistil.

Rhamnaceæ.—Sepals valvate, with the petals and stamens 4 or 5 each; the latter opposite the petals. Disk large and fleshy. Carpels united into a superior 2- 3- or 4-celled pistil.

Fabaceæ or Leguminosæ.—Sepals and petals 5 each, the latter papilionaceous. Stamens 10, monadelphous or diadelphous. Carpel solitary, superior, ripening into a legume.

Rosaceæ.—Sepals and petals 4 or 5 each. Stamens indefinite. Carpels distinct, more or less superior or inferior, ripening into a fruit which is not a legume.

Onagraceæ.—Sepals valvate, with the petals and stamens some power of 2 Carpels 4 or 2, united into an inferior many-celled ovary.

Lythraceæ.— Calyx tubular, strongly striated, its sepals, as well as the stamens, uncertain in number. Petals crumpled, inserted into the upper part of the calyx, much above the stamens. Carpels 2 or 4, united in a superior many-celled ovary.

Myrtaceæ.—Sepals and petals 4 or 5 each, dotted. Stamens indefinite in number. Carpels united into a many-celled inferior pistil, with a simple style and stigma.

r.—Sepals, petals, stamens, and carpels all distinct, and some power of 3, 4, 5, or 6. The carpels superior, opposite the petals, and many-seeded.

. - Sepals, petals, and stamens 5 each. Carpels united into an inferior 1-celled pistil, with two parietal placentæ. Fruit a berry.

Saxifragaceæ.—Sepals, petals, and stamens ∛. Carpels united into a pistil, with two many-seeded cells and two diverging styles. Fruit a membranous capsule.

Apiaceæ or Umbelliferæ.—Sepals, petals, and stamens 5 each. The latter inserted round a double epigynous disk. Carpels 2, united into an inferior pistil with 2 cells, 2 ovules, and 2 styles. Fruit separating into 2 achænia. Flowers in umbels.

TABULAR VIEW OF THE PRECEDING NATURAL ORDERS.

A. *Stamens indefinite in number.*
- *a.* Carpels wholly or in part distinct from each other. Leaves not dotted. *Rosaceæ.*
- *b.* Carpels wholly combined into one pistil Leaves dotted . *Myrtaceæ.*

B. *Stamens definite in number*
- *a.* Ovary more or less superior.
  - α. Flowers papilionaceous. *Leguminosæ.*
  - β. Flowers regular, with two many-seeded carpels, and divaricating styles in the fruit. *Saxifragaceæ.*
  - γ. Flowers regular, with the sepals, stamens, and carpels all distinct, and of the same power. *Crassulaceæ.*
  - δ Flowers regular, with a valvate calyx, stamens opposite the petals, and solitary erect ovules. *Rhamnaceæ*
  - ε. Flowers regular, with an imbricated calyx, stamens alternate with the petals, and a few erect ovules. *Celastraceæ.*
  - ζ. Flowers regular, with a tubular calyx, between whose lobes the petals are inserted far above the stamens
- *b.* Ovary completely inferior.
  - α. All the parts of the flower ∛. *Onagraceæ.*
  - β. Sepals, petals, and stamens 5 each, the latter inserted round a double fleshy epigynous disk. Fruit double, dry. Flowers in umbels. *Umbelliferæ*
  - γ. Sepals, petals, and stamens 5 each, the latter inserted on the calyx. Fruit a berry with parietal placentæ. *Grossulariaceæ.*

The following is a detailed account of these orders, together with some of their commoner genera and species —

ORDER XX. CELASTRACEÆ.—SPINDLE-TREES.

ESSENTIAL CHARACTER. *Sepals* 4 or 5, imbricated. *Petals* inserted by a broad base under the margin of the disk, with an imbricated æstivation. *Stamens* alternate with the petals, inserted into the disk. *Disk* large,

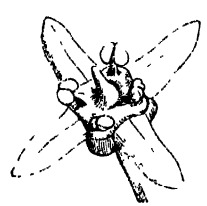
expanded flat, closely surrounding the ovary. *Ovary* superior, immersed in the disk and adhering to it, with 3 or 4 cells: *cells* 1- or many-seeded. *Fruit* superior, with 3 or 4 septiferous valves. *Seeds* ascending, often provided with an aril.—*Shrubs. Leaves* simple, alternate, or opposite. *Flowers* in axillary cymes.

*** These shrubby plants may be mistaken for Rhamnaceæ, unless attention is paid to their stamens, which are alternate with the petals. They cannot be confounded with Rosaceæ, because they have only 5 stamens; nor with Onagraceæ, because their fruit is superior and their parts are not regularly 3.

Fig. CXVI. *b*.

EUONYMUS.

Calyx 4-6-lobed, flat, with a peltate disk in the bottom. Petals 4-6, spreading, inserted in the disk. Stamens 4-6, inserted into glands projecting from the disk, alternate with the petals. Style 1. Capsule 3- or 5-celled, with 3 or 5 angles; dehiscence loculicidal. Seeds from 1 to 4, with a fleshy aril. — Shrubs with square branches. Leaves generally opposite. Peduncles axillary.



1. E. *europæus* (*The Spindle Tree*). Flowers mostly 4-cleft. Petals acute. Branches smooth and even. Leaves elliptical-lanceolate, serrulated, smooth. Aril red, enclosing the whole seed.——*Hedges and shrubberies.* A deciduous shrub. Wood hard, used for making butchers' skewers.

2. E. *verrucosus.* Petals roundish. Branches terete, warted. Leaves elliptical, serrulate, smooth. Aril red, not covering more than half the seed.——*Central Europe. Shrubberies.* Flowers pale fuscous: that is to say, green with minute brown specks.

3. E. *latifolius.* Branches somewhat compressed, smooth. Leaves oblong-elliptical, serrulate, smooth. Capsules somewhat winged.——*Alps of Europe. Shrubberies.* Capsule purple, with an orange-coloured aril.

Fig. CXVI. *b*.—Euonymus europeus. * A flower magnified.

STAPHYLEA.

Calyx 5-parted, with an urceolate disk. Petals 5. Ovary 2- or 3-lobed. Styles 2 or 3, sometimes combined. Fruit membranous, of 2 or 3 cells, resembling an inflated bladder. Seeds bony, roundish, truncate at the hilum.—Flowers large, white, in racemose panicles.

1. S. *pinnata* (*The Bladder Nut*). Leaves pinnate; leaflets 5-7, oblong-lanceolate, quite smooth, serrated. Flowers in racemes.——*Shrubberies.* A deciduous shrub.

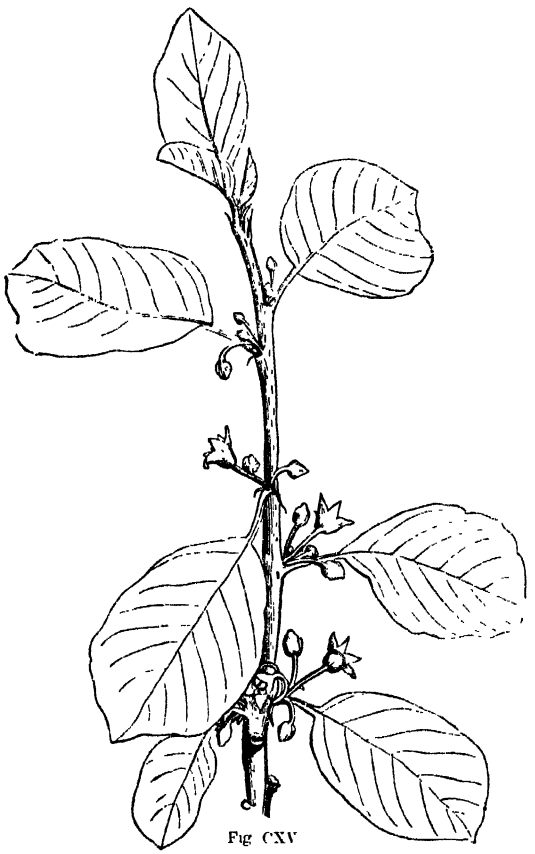


Fig CXV

ORDER XXI. RHAMNACEÆ.—RHAMNADS.

ESSENTIAL CHARACTER.—*Calyx* 4-5-cleft, with a valvate æstivation. *Petals* distinct, cucullate, or convolute, inserted into the orifice of the calyx, occasionally wanting. *Stamens* opposite the petals. *Disk* fleshy. *Ovary* superior, or half superior, 2- 3- or 4-celled. *Fruit* fleshy and indehiscent, with 2 or 3 erect seeds; or hard and dry.——

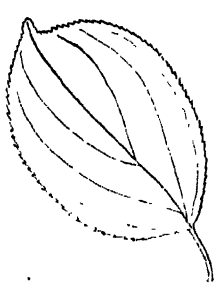


Fig. CXVII

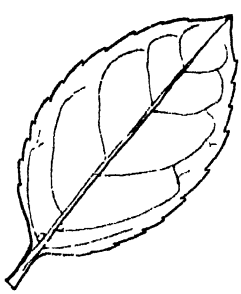


Fig. CXVIII.

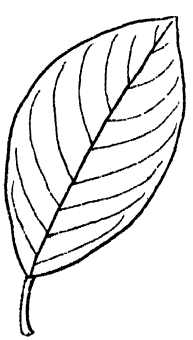


Fig CXIX.

Fig. CXVI. c.—Branch in flower of Rhamnus Frangula.
Fig CXVII.—Rhamnus catharticus. Fig CXVIII.—R. Alaternus. Fig. CXIX.—R. Frangula.

Trees or *shrubs*, often spiny. *Leaves* simple, alternate, with minute *stipules*. *Flowers* axillary or terminal, small and inconspicuous.

*** The valvate æstivation of the calyx and the stamens opposite the petals, which stand over them like hoods, will enable the student to know the plants of this natural order. The petals, however, are sometimes absent.

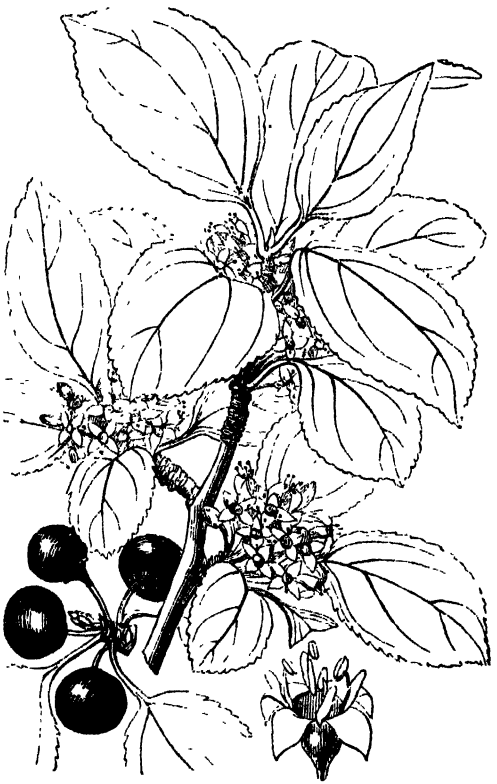


Fig. CXIX. *b*

Calyx flat, 5-cleft, deciduous, cut round at the base, which remains adherent to the fruit. Petals and stamens arising from the edge of a fleshy disk. Styles 2—3. Drupe succulent.

1. Z. *vulgaris* (*The Jujube tree*). Leaves ovate, retuse, toothletted, shining, pale green. Prickles in pairs or missing.—— —*Syria. Flowers green.* From the fruit of this Jujube lozenges, so much employed in sore throat, are prepared.

PALIURUS.

Flowers like those of Zizyphus. Fruit dry, surrounded by a broad circular wing.

1. P. *aculeatus* (*Christ's thorn*). Branches downy. Leaves ovate, 3-nerved. Prickles strong, hooked backwards.————*Syria. In gardens.* A very common hedge plant in Italy. From this species the crown of thorns was made in which our Saviour was crucified.

RHAMNUS.

Calyx urceolate, 4-5-cleft. Petals 0, or emarginate. Anthers ovate, 2-celled. Disk

Fig. CXIX. *b*.—Rhamnus catharticus in flower and fruit.

thin, overspreading the tube of the calyx. Ovary superior, 3- or 4-celled. Styles 3 or 4, distinct or united. Fruit fleshy, with 3 or 4 indehiscent stones.

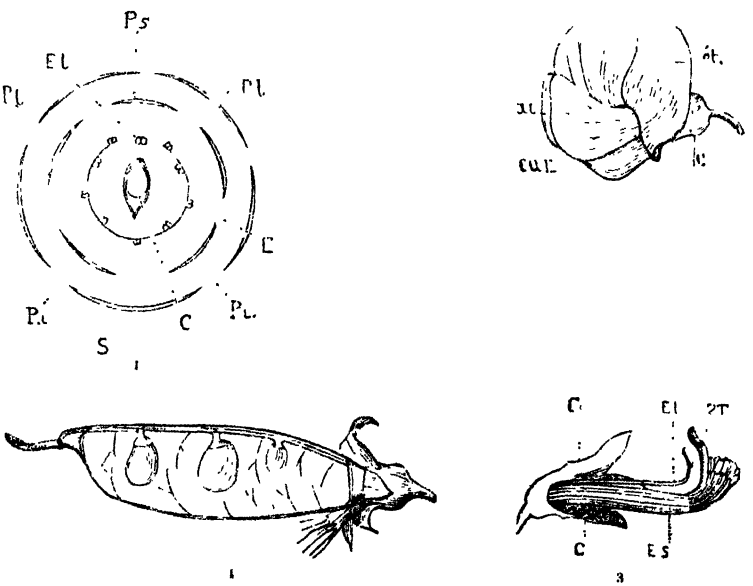
1. R. *catharticus* (*Buckthorn*). Thorns terminal. Flowers 4-cleft, dioecious. Leaves ovate or oblong, serrated Stem erect. Berry with four stones. ———— *Hedges.* A deciduous shrub, whose berries are purgative, and used by dyers for producing a yellow colour. They have a small gland at the end of each of the teeth of the edge.

2. R. *Frangula* (*Black Alder*). Thorns none. Flowers all perfect. Style simple. Leaves entire, elliptical, acute, smooth. Berry with two stones, black.———— *Hedges and woods.* A deciduous shrub. Its berries are purgative. Its wood makes the best charcoal for rifle powder.

3 R. *Alaternus* (*The Alaternus*). Thorns none. Leaves ovate, elliptical or lanceolate, distantly toothed, quite smooth, coriaceous, evergreen. Racemes axillary, very short Flowers dioecious. ———— *Istria. Shrubberies.* An evergreen shrub. This very common and beautiful evergreen is often mistaken for a Phillyrea. It may be easily known by its leaves being alternate, not opposite.

ORDER XXII. FABACEÆ.—LEGUMINOUS PLANTS.

ESSENTIAL CHARACTER. *Calyx* 5-parted or 5-toothed, very often irregular, and with the segments variously combined. *Petals* 5, inserted into the base of the calyx, either papilionaceous*, or regularly spreading. *Stamens* 10, either distinct or monadelphous, or diadelphous. *Ovary* simple, superior, 1-celled, 1- or many-seeded ; *style* simple, proceeding from the upper margin ; *stigma* simple. *Fruit* a legume. *Seeds* attached to the



upper suture, solitary or several ; *embryo* destitute of *albumen*, either straight, or with the radicle bent upon the cotyledons ; *cotyledons* either

* Papilionaceous, or butterfly-shaped, is when the upper petal, called the *standard*, is large and spreading, and two other petals, called *wings*, are small and stand forward, pressing upon two other petals joined together into a *keel.*

Fig. CXX.—Pisum sativum. 1. A diagram of the flower : *s* sepals, *p* petals, *e* stamens, *c* carpel ; 2 a flower : *et* standard, *al* wings, *car.* carina or keel, *c* calyx ; 3. stamens : *c* calyx, *ét.* stamens, *st.* style. 4. half the pistil

remaining under ground in germination, or elevated above the ground, and becoming green like leaves.—*Herbaceous* plants, *shrubs*, or *trees*, extremely variable in appearance. *Leaves* alternate, most commonly compound; *petiole* tumid at the base. *Stipules*, 2 at the base of the petiole, and 2 at the base of each leaflet. *Pedicels* usually articulated, with 2 bractlets under the flower.

*** So far as the European Flora is concerned, the papilionaceous flowers generally characterise this order. In other countries, it varies very much from that structure. The legume, as the fruit is called, is very often twisted or shortened in a remarkable manner, so as to have no resemblance to that of the Pea, which is generally taken as an illustration of it. This is well shown by the annexed illustrations:—1. Is the straight lomentaceous or jointed legume of Æschynomene americana; 4. The curved membranous one of Medicago radiata; 7. The tough spiral one of Medicago orbiculata, one of the plants called Snails; 5. The kidney-shaped one of Medicago circinata; 2. The coiled up knobby one of Scorpiurus sulcata, the Caterpillar plant; 3. The round-netted one of Melilotus italica; 6. The thin one, notched on both edges, of Biserrula Pelecinus.

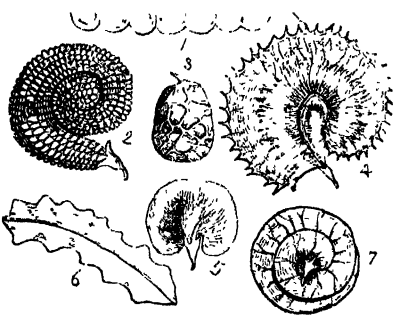


Fig. CXXI.

Fig. CXXI. *b*

CYTISUS

Calyx 2-lipped; the upper lip generally entire, the lower slightly 3-toothed. Standard ovate, large. Keel very blunt, enclosing the stamens. Stamens monadelphous. Pod compressed, flat, many-seeded, without glands.—Shrubs with yellow, white, or purple flowers, and ternate leaves.

1. C. *scoparius* (*The Broom*). Leaves ternate, or solitary. Branches angular, without thorns. Legume fringed. Style very long, curled inwards. Stigma terminal, minute, capitate.——*Heaths and commons.*

2. C. *alpinus* (*The Scotch Laburnum*). Smooth. Racemes lateral, many-flowered, pendulous. Leaflets elliptical, somewhat downy at the edge with spreading hairs.

Fig. CXXI *b*.—Cytisus scoparius

Pods smooth, with the upper suture winged.——*Shrubberies.* A tree. The seeds of this and the next are extremely poisonous.

3. C. *Laburnum* (*Common Laburnum*). Closely downy. Racemes lateral, many-flowered, pendulous. Leaflets elliptical, smooth above. Pods silky, with the upper suture angular and carinate.——*Shrubberies.* A tree.

4. C. *nigricans.* Closely downy. Racemes terminal, many-flowered, erect. Leaflets obovate and oblong, smooth above. Calyxes without bracts.——*Midland parts of Europe. Shrubberies.* A deciduous bush.

GENISTA.

Calyx 2-lipped; the upper lip 2-parted, the lower 3-toothed. Stamens monadelphous. Keel blunt. Leaves simple, or ternate.

1. G. *tinctoria* (*Dyer's Broom*). Erect. Spines none. Leaves simple, lanceolate, nearly smooth. Flowers in racemose spikes. Corolla and legumes smooth.—— *Wild in thickets. Flowers yellow.* Dyes yellow.

2. G. *pilosa.* Procumbent. Spines none. Leaves simple, obovate-lanceolate, folded up, silky on the under side. Flowers axillary. Corolla and legumes downy. ——*Heaths and moors.* Flowers smaller than in the last and brighter yellow.

3. G. *anglica* (*Petty Whin*). Spines very numerous. Leaves simple, ovato-lanceolate, smooth. Flowers axillary. Corolla and legumes smooth.——*Commons and moors.* The calyx distinguishes this from all forms of Ulex.

LUPINUS.

Calyx bilabiate. Stamens monadelphous; anthers half sterile; style subulate, ascending. Stigma capitate. Keel rostrate. Pod coriaceous, with spongy partitions.

1. L. *hirsutus* (*Dutch Blue Lupine*). Flowers large, blue, or pink, alternate, with little bracts at the base of the calyx. Upper lip of the calyx 2-parted, lower ¼-trifid. Leaflets oblong, or obovate-cuneate, hairy on both sides.—— *Gardens.* An annual.

ULEX

Calyx with 2 bracts, 2-lipped; the upper lip with 2, the lower with 3 teeth. Stamens monadelphous. Pod oval-oblong, turgid, scarcely longer than the calyx, few-seeded.—Branching spiny shrubs. Flowers solitary, yellow. Pods villous.

1. U. *europæus* (*Furze*). Teeth of the calyx obsolete, converging. Bracts ovate, lax. Branches erect, downy, angular, spiny.———*Heaths and commons.* A useful food for horses and other animals.

ONONIS.

Calyx campanulate, 5-cleft, with linear segments. Standard large, streaked. Stamens monadelphous. Pod turgid, sessile, few-seeded.—Herbaceous plants or under-shrubs. Leaves ternate, occasionally simple. Flowers axillary, yellow or purple. Pedicels often bearing a bristle indicating an abortive floral leaf.

1. O. *spinosa* (*Rest-harrow*). Stem nearly erect, spinous, with one or two separate rows of hairs. Leaves ternate, oblong, wedge-shaped and entire towards the base. Flowers pink, solitary. Lobes of the calyx shorter than the pods.——*Fields.*

GALEGA.

Calyx campanulate, 5-toothed, withering. Keel obtuse, monopetalous. Stamens monadelphous: the teeth united half-way; filaments subulate. Style smooth, filiform. Legume 2-valved, linear, somewhat terete, torulose, obliquely striated.

1. G. *officinalis* (*Goat's Rue*). Leaves pinnate; leaflets lanceolate, mucronate, smooth. Stipules broad-lanceolate. Racemes longer than the leaves.———*Germany, in marshy or wet places. Gardens, common.*

CORONILLA.

Calyx short, campanulate, 5-toothed; the 2 upper teeth united above the middle. Keel rostrate. Stamens diadelphous: the longer filaments dilated at the apex. Legume long, straight or curved, jointed more or less.

1. C. *Emerus* (*Scorpion Senna*). Shrubby, erect. Leaves pinnate; leaflets 7—9 obovate; stipules free, lanceolate. Claws of petals three times as long as the calyx. ———*Germany. Common in shrubberies. Flowers bright yellow.* Leaves very purgative.

GLYCYRRHIZA.

Calyx two-lipped, the two upper teeth united as far as the middle. Petals of keel separate, acute. Stamens diadelphous. Legume 2-valved, ovate or oblong, compressed, 1—4-seeded.

Fig. CXXI. *c*

1. G. *glabra* (*Liquorice*). Leaves pinnated; leaflets ovate, blunt, resinous on the under side. Stipules 0. Spikes stalked. Flowers distant. Legumes smooth.——*South of Europe. Gardens; occasionally in fields.* The root yields the well-known sweet extract called Liquorice.

ONOBRYCHIS.

Calyx 5-cleft, with nearly equal divisions. Keel obliquely truncate, longer than the wings. Stamens diadelphous; filaments subulate. Legume 1-jointed, compressed, indehiscent, one-seeded, variously wrinkled; the upper edge thick and straight, the lower curved, toothed, spiny or lobed.

1. O. *sativa* (*Saintfoin*). Stem ascending, 2—3 feet high. Leaves pinnate; leaflets in 8 pairs with an odd one, oblong, acute. Flowers in close long-stalked spikes. Legume with elevated network at the side, and with spiny teeth on the edge and disk.——*Commonly cultivated for cattle in chalky districts.* Flowers rose-coloured, with darker streaks, and the tip of the wings violet.

TETRAGONI

Calyx 5-cleft, or 5-toothed. Keel beaked, ascending. Stamens diadelphous; filaments dilated at the upper end. Legume with 4 leafy wings.

1. T. *purpureus* (*Winged Pea*). Flowers solitary or in pairs. Peduncle as long as the leaf. Flowers yellow or purple.——*Common in Gardens.* The winged pods are very peculiar.

SCORPIURUS.

Calyx short, campanulate, 5-toothed, somewhat 2-lipped. Keel acuminate. Stamens diadelphous; their filaments alternately dilated. Legume circinate, covered with rows of warts, and consisting of 3—6 one-seeded joints.

1. S. *sulcatus* (*Caterpillars*). An annual. Stipules membranous. Leaves simple, entire. Peduncles axillary, larger than the leaves, 1—4-flowered. Legume with all the warts of the same size, those at the back being a little hooked.——*Gardens. Mediterranean.* The legume of this is represented at p. 55, fig. cxxi, 2.

2. S. *subvillosus* (*Caterpillars*). Like the last, except that the inner ribs of the legume are even, and the outer furnished with 6-8 hooked spines.——*Gardens with the last.*

Fig. CXXI. *c*.—Glycyrrhiza glabra.

MELILOTUS.

Calyx tubular, 5-toothed. Keel simple; wings shorter than the standard. Pod longer than the calyx, coriaceous, 1- or few-seeded, indehiscent, of various forms.—Herbaceous plants. Stipules adnate to the petiole. Leaves 3-leaved; leaflets often toothed. Flowers in loose racemes, either yellow or white.

Fig. CXXII.—Melilotus cærulea

1. M. *officinalis* (*Common Melilot*). Racemes unilateral, rather lax. Legume ovate, acute, transversely wrinkled, hairy and compressed at the upper edge; with two seeds. Stem erect. Stipules awl-shaped ——— *Fields.* Flowers yellow.

2. M. *cærulea* (*Sweet Melilot Old Sow.*) Flowers blue, in round heads. Pods extended into long beaks, streaked with longitudinal veins. Stipules ovate, awl-pointed. Leaflets oblong, lanceolate, finely serrated.—*Gardens.* The whole plant has a singular and not unpleasant aromatic smell It is said to give Swiss cheese called *Schapziger.*

Calyx somewhat cylindrical, 5 cleft. Keel rather distant from the standard. Stamens diadelphous. Pod many-seeded, variable in form, always falcate or spirally twisted. Herbaceous plants or shrubs Stipules usually cut. Leaves stalked, trifoliate; leaflets toothed. Peduncles axillary, with 1, 2, or many flowers. Flowers yellow or purple.

1. M. *lupulina* (*Black Nonsuch*). Spikes ovate, erect Legumes kidney-shaped, rugged and veiny, single-seeded. Stem procumbent.——*Commons and fields.* Flowers small, yellow.

2. M. *sativa* (*Lucerne*). Racemes upright, many-flowered. Legumes sickle-shaped. Stem procumbent. Leaflets emarginate with a point, toothed at the end.———*Fields.* A perennial. Flowers blue. Much cultivated for horse forage.

3. M. *scutellata* (*Snails*). Peduncles 1-3-flowered, shorter than the leaf. Legumes unarmed, snail-shaped, convex below, flat above; with about 6 concentrically spiral turns. Stipules ovate, toothed. Leaflets elliptical, finely toothed, the lower obovate. ——*Gardens.* An annual. Flowers yellow. This curious plant derives its name from the singular nature of its fruit, which is twisted like the shell of a snail It is represented at No. 7, of cut CXXI.

The following are also commonly cultivated in Gardens, and may be purchased in the large seedshops under the English names added to them. They are all annuals, inhabiting the southern parts of Europe.

4. M. *orbicularis* (*Snails*). Legumes unarmed, snail-shaped, orbicular, depressed, lenticular, with about 6 turns overlapping each other by a membranous edge.

5. M. *tribuloides* (*Hedgehogs*). Legumes spiny, snail-shaped, cylindrical, slightly hairy, with about 5 turns which are thick and spiny along the back.

6. M. *disciformis* (*Hedgehogs*). Legumes snail-shaped, depressed-cylindrical, smooth, with 5 loose turns smooth and blunt at the edge, the uppermost being unarmed, the rest with 2 rows of spines.

TRIFOLIUM.

Calyx tubular, persistent, 5-cleft, not glandular; with subulate segments. Keel shorter than both wings and standard. Stamens diadelphous. Pod small, indehiscent, often ovate, with 1 or 2 seeds, shorter than the calyx by which it is covered, seldom oblong, with 3 or 4 seeds, and a little longer than the calyx.—Herbaceous plants. Stipules adhering to the petiole. Leaves 3- or 5-leaved. Flowers in heads or dense spikes, bracteate, purple, white, or pale yellow. Petals in some species united.

1. T. *repens* (*Dutch Clover*). Heads globose. Flowers somewhat stalked. Legume within the calyx, 4-seeded. Stems creeping, solid.——*Pastures.* Flowers white. Perennial.

2. T. *medium* (*Cow-grass*). Spikes lax. Stems zigzag and branching. Petals nearly equal. Stipules tapering, converging. Two upper calyx-teeth rather the shortest.——*Pastures.* Flowers purple. Perennial.

3. T. *pratense* (*Purple Clover*). Spikes dense. Stems ascending. Petals unequal. Calyx hairy; four of its teeth equal. Stipules ovate, bristle-pointed.——*Pastures.* Flowers purple. Biennial. These three species are commonly cultivated by farmers; the others are only weeds.

4. T. *arvense*. Spikes cylindrical, very hairy. Stipules lanceolate, bristle-pointed Calyx-teeth longer than the corolla, permanently bristle-shaped. Leaflets linear-obovate.——*Fields.* Flowers very small, pink.

5. T. *minus*. Heads hemispherical. Flower-stalks straight, rigid. Standard nearly even. Stems prostrate. Stipules ovate. Common footstalk very short. Style 4 times as short as the legume.——*Fields.* Flowers yellow, eventually bent downwards.

Calyx tubular, 5-cleft; wings about as long as the standard; keel beaked. Pod cylindrical or compressed, wingless; style straight, subulate.—Herbaceous plants. Leaves ternate. Stipules leafy. Peduncles axillary, from 1 to 6-flowered, supported by a floral leaf. Flowers yellow, rarely white or pink.

1. L. *corniculatus*. Heads depressed, long-stalked, of few flowers. Stems recumbent, pithy. Legumes spreading, very slender, nearly cylindrical. Claw of the standard [illegible]'c. Filaments all dilated.——*Commons and fields.* Flowers yellow.

COLUTEA.

Calyx 5-toothed; the upper teeth shortest. Standard spread flat, with two callosities. Keel terminated by a short truncated beak. Stamens diadelphous; filaments filiform. Style hooked at the point, hairy from the base to the apex. Legume stalked, inflated.

1. C. *arborescens* (*Bladder Senna*). Leaflets elliptical, retuse. Callosities of the standard short. Legumes quite closed.——*Shrubberies.* A deciduous shrub. Flowers large, yellow.

Calyx with bracts, tubular, nearly equally 5-toothed. Keel very small and compressed. Stamens diadelphous. Pod compressed, consisting of numerous 1-seeded, indehiscent joints, truncate equally on each side, with parallel margins.—Hairy annuals Leaves pinnate. Stipules small, adhering to the petiole. Peduncles axillary, few-flowered. Flowers small, white or rose colour. A leafy pinnated bract under each head.

1. O. *perpusillus* (*Birdsfoot Trefoil*). Leaves pinnate. Flowers capitate, accompanied by a leaf. Legumes incurved, bearded.——*Commons and fields.*

VICIA.

Calyx tubular, 5-cleft or 5-toothed, the 2 upper teeth shorter than the others. Stamens diadelphous. Style filiform, at nearly right angles with the ovarium, villous on the upper side, and below the apex on the under. Pod oblong, 1-celled, many-seeded. Seeds with an oval or linear lateral hilum.—Climbing herbaceous plants. Leaves abruptly pinnate, with a tendril in place of an odd leaflet. Stipules generally sagittate. Peduncles axillary, either long and many-flowered, or short and 1-flowered.

1. V. *sativa* (*Common Vetch*). Flowers nearly sessile, mostly in pairs. Leaflets elliptic-oblong; lower ones abrupt. Stipules with a blackish depression beneath. Seeds orbicular, smooth. ——*Fields.* Flowers purple.

PISUM.

Calyx with foliaceous segments, the 2 upper shortest. Standard large reflexed. Style

compressed, keeled, villous on the upper side. Pod oblong, compressed, not winged, many-seeded. Seeds roundish, with a roundish hilum.—Annuals. Leaves abruptly pinnate, of 3 pairs, with a tendril in place of a terminal leaflet. Stipules large.

1. P. *sativum* (*Garden Pea*). Stipules ovate, half-cordate, toothed at the base. Leaflets in 3 pairs, ovate, entire, wavy at the edge. Peduncles 2- or many-flowered. Seeds globose, pale straw-coloured.——*Gardens.* Flowers white.

2. P. *arvense* (*Grey Pea*). Stipules ovate, half-cordate, toothed at the base. Leaflets in 2 or 3 pairs, ovate, crenulated. Peduncles with about 2 flowers. Seeds angular, impressed, brown speckled.———*Fields.* Flowers purple.

Fig. CXXIII.

The same as Vicia, but the seeds oblong, with a long scar on the shorter edge, the peduncles shorter than the flowers, and the pods leathery, and tumid.

1. F. *vulgaris* (*Garden Bean*). Racemes axillary, 2-4-flowered, very short Leaflets terminated by a mucro, the upper in 2 pairs, elliptical, obtuse. Pods downy. Seeds pale straw colour, with a black hilum. ——*Gardens.*

Calyx bilabiate; the upper lip 2-, the lower 3-toothed. Style bearded above, spirally twisted, together with the stamens and keel. Legume with soft spongy partitions separating the seeds.

1. P. *vulgaris* (*Kidney-bean*). Leaflets 3, ovate, acuminate. Racemes stalked, shorter than the leaves. Stem dwarf, erect.———*Gardens.* An annual.

2 P. *multiflorus* (*Running Kidney-bean*). Leaflets 3, ovate, acuminate. Racemes stalked, longer than the leaves. Stem twining.——*Gardens.* A perennial, with tuberous roots.

ORDER XXIII. ROSACEÆ.—ROSEWORTS.

ESSENTIAL CHARACTER.—*Calyx* 4- or 5-lobed, permanent, with a disk either lining the tube or surrounding the orifice. *Petals* 5, perigynous, equal. *Stamens* indefinite, arising from the calyx, just within the petals. *Ovaries* superior, either solitary or several, 1-celled, sometimes cohering into a plurilocular pistil, and adhering to the calyx; *styles* lateral; *stigmas* usually simple, and emarginate on one side. *Fruit* either 1-seeded nuts, or acini, or pomes, or drupes, or follicles containing several seeds.—*Herbaceous* plants, or *shrubs*, or *trees*. *Leaves* simple or compound, alternate, usually with 2 stipules at their base.

*** These plants have much general resemblance to Ranunculaceæ, but are known by their perigynous stamens, and permanent calyx. The following genera form the most genuine type of the order, from which the two sub-orders of Pomeæ and Amygdaleæ are a strongly marked departure.

Fig. CXXIII.—Pisum sativum, the garden Pea.

Sub-Order I. Roseæ.

Essential Character.—*Carpels* several, distinct from each other and from the calyx.

SPIRÆA.

Calyx 5-cleft, persistent. Stamens from 10 to 50, inserted along with the petals upon a disk adhering to the calyx. Follicles 1 or several, distinct, or occasionally cohering by the base.

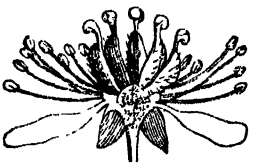


Fig. CXXIV.

1. S. *Ulmaria* (*Meadow Sweet*). Leaves interruptedly pinnate; downy beneath; the terminal leaflet largest and lobed. Stem herbaceous. Flowers cymose, with many styles. ——— *Meadows.*

2. S. *Filipendula* (*Dropwort*). Leaves interruptedly pinnate; leaflets uniform, serrated, smooth. Stem herbaceous. Flowers cymose, with many styles.——— *Meadows.*

3. S. *hypericifolia* (*Italian May*). Leaves obovate, entire or toothed, smooth. Flowers small, white, in corymbs, which cover all the ends of the drooping branches. ——— *Shrubberies.* A deciduous shrub.

FRAGARIA.

Calyx concave, 5-cleft, with 5 external bractlets. Petals 5. Stamens indefinite. Fruit consisting of numerous small nuts, placed upon a succulent receptacle. Seed inverted —Herbaceous plants, propagating themselves by runners. Leaves ternate or simple.

1 F. *vesca* (*Wood Strawberry*). Calyx of the fruit reflexed. Hairs of the footstalks widely spreading; those of the partial flower-stalks close-pressed, silky. ——— *Woods.*

Fig. CXXV.

Fig CXXV.—Fragaria vesca, or Wild Strawberry. 1. A flower magnified; 2. a perpendicular section of it, 3. a carpel cut through perpendicularly; 4. do. showing the embryo.

Calyx concave, 5-cleft, with 5 external bractlets. Petals 5. Stamens indefinite. Fruit consisting of numerous small nuts, tipped with the hardened persistent naked styles, and placed upon a dry receptacle. Seed ascending.—Herbaceous plants with compound le

1. G. *urbanum* (*Avens*). Leaves ternate; radical ones somewhat lyrate. Stipules rounded, cut. Flowers nearly upright. Styles naked.—— *Hedges.* Flowers small, yellow.

2. G. *rivale.* Radical leaves lyrate-pinnate, cauline ternate. Flowers nodding Calyx purple. Petals dull orange colour, the length of the erect calyx. Indurated styles double-jointed, the upper joint shaggy and as long as the lower, which is hairy at the base.——*Marshes and small rivulets.*

FIG CXXV *b*

Calyx somewhat campanulate, 5-lobed, without external bractlets. Petals 5. Stamens indefinite Fruit consisting of numerous succulent drupes, placed upon an elevated dry receptacle. Seed inverted. —Shrubs or herbaceous plants. Stems usually long and procumbent, sterile the first year, bearing flowers and fruit the second, and then perishing. Leaves either simple, ternate, quinate, pedate, or pinnate, always more or less divided at the margin.

1. R. *Idæus* (*Raspberry*). Stem round, erect, smooth, with downy branches; their prickles straight and slender. Leaves pinnate, of 5 or 3 ovate, rather angular leaflets, very downy beneath. Clusters prickly, somewhat compound. Flowers pendulous.—— *Gardens and woods.*

2. R. *fruticosus* (*Bramble*). Stem arched, angular, furrowed, aculeate, smooth. Leaflets quinate, ovate-oblong, acute, white and downy beneath. Panicle decompound, narrow, straight. Calyxes reflexed, almost unarmed.——*Hedges.*

3. R. *corylifolius* (*Bramble*). Stem arched, angular, prickly and glandular in various degrees. Leaflets quinate or ternate, rugose, not shining, green beneath with coarse hairs.——*Hedge-rows.*

N.B. *R. fruticosus* and *corylifolius* have been greatly subdivided into other supposed

species by some modern writers. It is, however, doubtful whether they do not all in reality belong to the two types here mentioned.

POTENTILLA.

Calyx concave, 4 or 5-cleft, with 4 or 5 external bracteolæ. Petals 5. Stamens indefinite. Fruit consisting of numerous small nuts, placed on a dry elevated receptacle. Seed inverted.—Herbaceous plants or shrubs. Leaves compound. Stipules adhering to the petiole. Flowers white, yellow, or purple.

1. P. *reptans*. Leaflets 5, obovate, serrated. Stem creeping. Flower-stalks axillary, long, single-flowered. Petals 5.——*Hedges.*

2. P. *Tormentilla*. Stem ascending, branched. Leaves almost sessile. Stipules none, or 3-toothed. Flower-stalks long, axillary, single-flowered. Petals 4.——*Hedges.*

3. P. *anserina* (*Goosewort, Silver-weed*). Leaves interruptedly pinnate, serrated, silky. Stem creeping. Stalks axillary, solitary, single-flowered.——*Commons and ditch sides in moist places.*

4. P. *Fragaria* (*Sterile Strawberry*). Leaves ternate; leaflets obovate, rather shining, silky. Petals as long as calyx, white. Stem prostrate.——*Dry banks and woods in the spring.* Once called Fragaria sterilis, but not a Fragaria, because the torus is dry and permanent, not succulent and deciduous.

COMARUM.

In all respects like Potentilla, except that the achænia stand on a permanent spongy receptacle or torus. (If the torus were deciduous this would not differ from Fragaria.)

1. C. *palustre* (*Marsh Cinquefoil*). Leaflets 7, lanceolate, deeply serrated, the upper one quinate or ternate. Stipules ovate. Flowers deep dull purple, with the petals much shorter than the calyx.——*Marshes and bogs.*

ROSA.

Nuts numerous, hairy, terminated by the persistent style, and enclosed within the fleshy

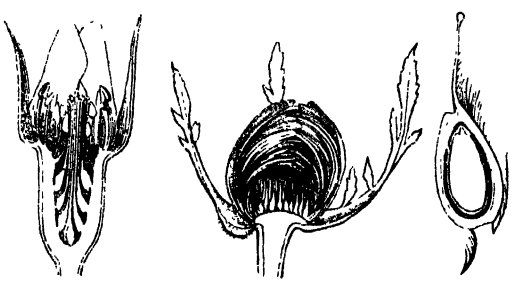


Fig CXXVI

tube of the calyx, which is contracted at the orifice, where it is surrounded by a fleshy disk. Sepals 5. Petals 5. Stamens indefinite. Shrubs with prickly or naked stems. Leaves pinnate. Flowers red, white, or yellow, usually fragrant.

1. R. *arvensis*. Root-shoots long, trailing. Prickles unequal, falcate. Leaves deciduous, glaucous beneath. Styles united into a column.——*Hedges; in chalky countries chiefly.*

2. R. *canina* (*Dog-Rose*). Leaflets ovate, acute, smooth on both sides. Prickles falcate, even-sized. Fruit red, with deciduous sepals, and supported by permanent bracts.——*Hedge-rows.*

3. R. *spinosissima* (*Scotch Rose*). Leaflets ovate, acute, smooth, with simple serratures. Prickles straight, very numerous and unequal, many of them glandular. Fruit black, with permanent sepals, not supported by bracts.——*Hedges.*

4. R. *rubiginosa* (*The Sweet-briar*). Leaflets roundish-ovate, covered on the under side with fragrant resinous glandular hairs.——*Hedge-rows and gardens.*

Fig CXXVI.—1. Vertical section of the flower of a rose; 2. monstrous state of it, with the receptacle flattened; 3. ripe nut cut perpendicularly.

AGRIMONIA.

Calyx turbinate, with a 5-cleft limb which curves inwards after flowering; beneath the calyx numerous soft hooked prickles, which become hard and larger when the fruit is ripe. Petals 5. Stamens about fifteen, arising from the outside of an

Fig. CXXVI. *b*

annular faucial disk. Carpels 2, with terminal styles; when ripe often solitary and invested by the hardened bur-like calyx.

1. A. *Eupatorium* (*Agrimony*). Leaves interruptedly pinnate; leaflets oblong-lanceolate, serrate, hoary with hairs on the under side; some small lobes interposed. Spikes long, rod-like. Flowers yellow.———*Hedge-rows and woods.*

N.B. This genus offers so direct a transition to SANGUISORBS (p. 109), that it would actually belong to them if it had no petals.

a; c a perpendicular section of flower.

Sub-Order II. Pomeæ.

Essential Character.—*Calyx* superior. *Ovaries* from 1 to 5, adhering more or less to the sides of the calyx and each other; *styles* from 1 to 5; *stigmas* simple. *Fruit* a pome, 1- to 5-celled; the endocarp either cartilaginous, spongy, or bony. *Trees* or *shrubs*.

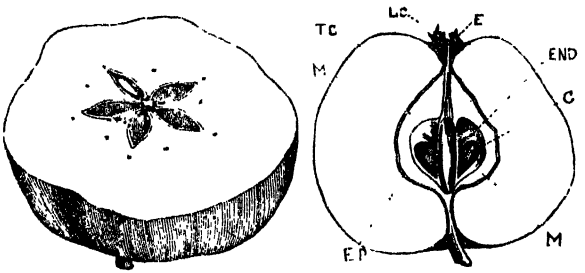


Fig. CXXVII.

Leaves alternate, stipulate, simple, or compound. *Flowers* in terminal cymes, white or pink.

Pyrus.

Calyx 5-toothed. Petals roundish, spreading. Styles 2, 3, or 5. Fruit fleshy, with 5 distinct cells. Endocarp cartilaginous. Seeds 2 in each cell. Testa cartilaginous.—Trees with serrated, undivided, or pinnated leaves, and cymose flowers. Bracteæ deciduous.

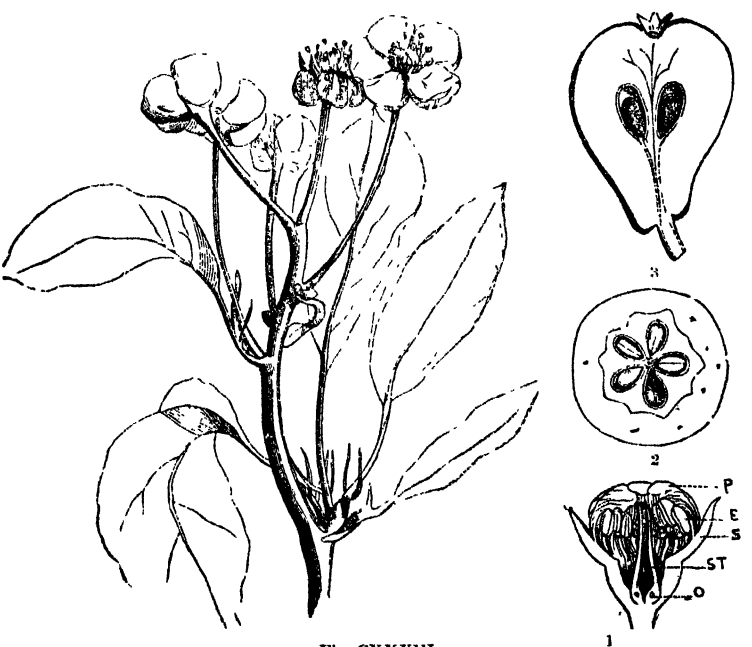


Fig. CXXVIII.

Fig. CXXVII.—1. A perpendicular section of an apple; *lc.* remains of the calyx; *c.* remains of stamens; *tc.* fleshy sides of the calyx tube; *end.* endocarp; *m.* mesocarp, *ep.* epicarp, *g.* seed; 2. a cross section of the same.

Fig. CXXVIII.—Pyrus communis, the Pear-Tree. 1. A flower divided vertically; *o.* ovary; *st.* styles; *s.* sepals; *c.* stamens; *p.* petals; 2. a cross section; 3. a perpendicular section of a ripe fruit.

1. P. *Malus* (*Apple*). Leaves simple, serrated, rugose. Flowers in a simple sessile umbel. Fruit umbilicate at each end, not gritty round.———*Orchards and gardens.*

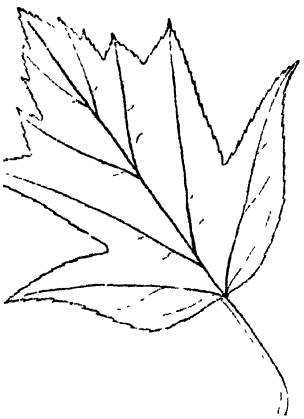


Fig. CXXIX.

2. P. *communis* (*Pear*). Leaves simple, ovate, serrated. Flower-stalks corymbose. Fruit turbinate, gritty.———*Orchards and gardens.*

3. P. *Aucuparia* (*Mountain Ash*). Leaves pinnate; leaflets uniform, serrated, smooth. Flowers corymbose. Styles about 3. Fruit globular.———*Plantations and woods.*

4. P. *torminalis* (*Service Tree*). Leaves cordate, ovate: lobed in a pinnatifid manner, when young downy beneath. Flowers corymbose.——*Woods and plantations.*

Segments of the calyx acute. Petals roundish. Styles 2 to 5. Fruit oval or round, concealing the upper ends of the carpels. Endocarp bony.—Trees with lobed leaves. Flowers corymbose.

1 C. *Oxyacantha* (*Whitethorn*). Leaves obovate, wedge-shaped, either entire, trifid, or cut, quite smooth, and rather lucid. Flowers in corymbs, with from 1 to 3 styles. Calyx destitute of glands.———*Hedges.*

Sub-Order III. ——

ESSENTIAL CHARACTER.—*Calyx* with the tube lined with a waxy disk. Carpel superior, solitary. *Fruit* a drupe.

AMYGDALUS.

Drupe covered with a woolly skin, and having a stone marked by deep irregular furrows.

1. A. *communis* (*Almond*). Flesh of the drupe dry, splitting spontaneously into two valves.——*Gardens.* A tree.

2. A. *Persica* (*Peach.*) Flesh of the fruit juicy, not splitting.———*Gardens.* A tree. No doubt a cultivated variety of the almond.

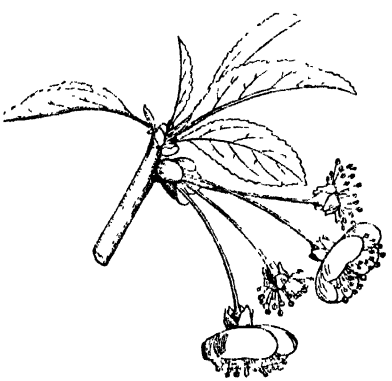


Fig. CXXX.

CERASUS.

Vernation conduplicate. Drupe not covered with bloom, with a smooth stone not furrowed at its inner edge.

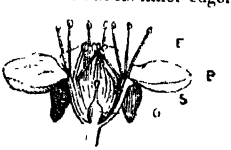


Fig. CXXXI

1. C. *lusitanica* (*Portugal Laurel*). Racemes straight, axillary, longer than the leaf. Leaves ovate-lanceolate, serrated, not glandular, evergreen.——*Gardens.*

2. C. *Lauroceraus* (*Common Laurel*). Racemes shorter than the leaves. Leaves ovate-lanceolate, distantly serrated, coriaceous, evergreen. Fruit black, round, bitter.———*Gardens.* A native of the Coast of the Black Sea.

Fig. CXXIX.—Leaf of Pyrus torminalis.
Fig. CXXX.—Umbel of the common Cherry.
Fig. CXXXI.—Vertical section of the flower of a Cherry: *o.* ovary; *s.* sepal; *p.* petal, *c.* stamens

3. C. *Padus* (*Bird Cherry*). Racemes long, pendulous. Leaves ovate-lanceolate, acuminate, thin; smooth beneath, with spreading serratures. Fruit round, bitter. ——— *Woods.*

4. C. *communis* (*Cherry*). Umbels many-flowered, before the leaves. Leaves flat, smooth, shining, somewhat coriaceous, elliptical, all acuminated. ——— *Gardens.*

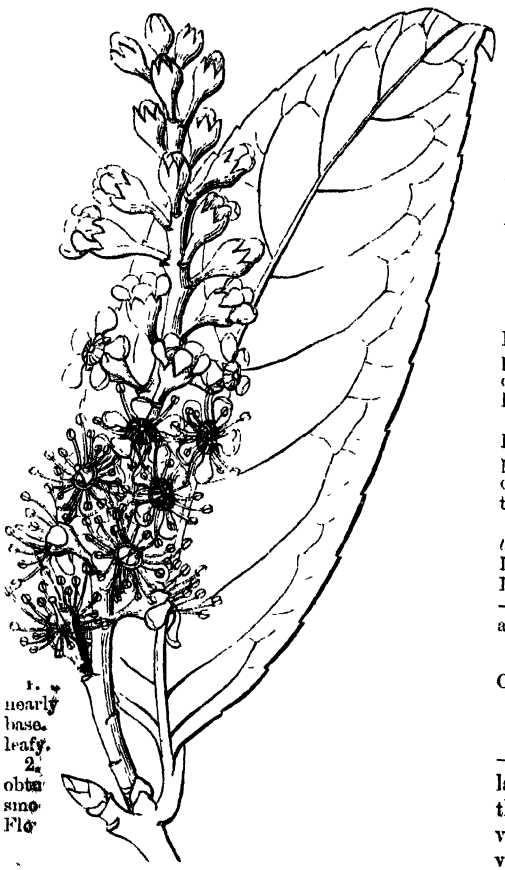


Fig CXXXI. *b*

PRUNUS.

Vernation convolute. Drupe covered with bloom, with a smooth stone deeply furrowed at its inner edge.

1. P. *Armeniaca* (*Apricot*). Flowers lateral, solitary or in pairs, on short stalks. Leaves ovate, somewhat cordate. Fruit downy. ——— *Gardens.*

2. P. *domestica* (*Plum*). Flower stalks solitary or in pairs. Leaves lanceolate-ovate. Branches without thorns. ——— *Gardens.*

3. P. *spinosa* (*Sloe, or Blackthorn*). Flower-stalks solitary. Leaves lanceolate, smooth. Branches thorny at the end. ——— *Hedge-rows.* Fruit very austere.

ORDER XXIV. ONAGRACEÆ.—ONAGRADS.

ESSENTIAL CHARACTER. —*Calyx* superior, tubular, with the limb 4-lobed; the lobes cohering in various degrees, with a valvate æstivation. *Petals* equal in number to the lobes of the calyx, into the throat of which they are inserted. *Stamens* 4 or 8, inserted into the calyx; *filaments* distinct; *pollen* triangular, usually cohering by threads. *Ovary* of 4 cells; *style* filiform; *stigma* either capitate or 4-lobed. *Fruit* baccate or capsular, many-seeded, with 4 cells. *Seeds* numerous.—*Herbaceous* plants or *shrubs*. *Leaves* alternate or opposite, simple, entire, or toothed. *Flowers* red, purple, white, blue, or yellow, axillary, or terminal.

*** The ♂, which exists in *all* the parts of the flower, will usually indicate this order with sufficient precision, if attention is paid to the ovary being inferior.

EPILOBIUM.

Calyx tubular, with a 4-parted limb, which falls off after flowering. Petals 4. Stamens 8. Capsule linear, bluntly 4-cornered, with 4 cells, 4 valves, and many seeds. Seeds pappose.—Herbaceous plants. Leaves opposite or alternate. Flowers axillary and solitary, or terminal in spikes, purple or rose colour.

Fig CXXXI. *b* —Cerasus Laurocerasus.

1. E. *angustifolium* (*French Willow*). Leaves scattered, linear-lanceolate, veiny, smooth. Petals unequal. Stamens declinate.——*Gardens.*

2. E. *hirsutum* (*Codlings and Cream*). Leaves half clasping the stem, ovate-lanceolate, hairy. Stem copiously branched. Root creeping.——*Meadows and ditches.*

3. E. *montanum*. Leaves stalked, ovate, toothed. Stem round. Stigma in 4 deep segments.——*Hedge-rows.*

Fig. CXXXI. *c*

ŒNOTHERA.

Calyx tubular, deciduous, with a reflexed 4-parted limb, the segments of which cohere irregularly. Petals 4. Stamens 8. Pollen cohering by threads. Stigma 4-lobed. Capsule linear or winged, with 4 cells, 4 valves, and many seeds. Seeds naked.—Herbaceous plants. Leaves alternate, toothed, or pinnatifid. Flowers sessile, axillary, solitary, or in terminal spikes, purple, red, yellow, or white.

1. Œ. *biennis*. Leaves ovate-lanceolate, flat. Stem rough, somewhat hairy. Stamens equal. Petals undivided.——*Gardens.*

CIRCÆA.

Calyx 2-parted. Petals 2, obcordate. Stamens 2, alternate with the petals.

1. C. *lutetiana* (*Enchanter's Nightshade*). Stem erect. Leaves ovate, slightly toothed, opaque and downy.——*Woods.* Flowers white.

ORDER XXV. LYTHRACEÆ.—LYTHRADS.

ESSENTIAL CHARACTER.—*Calyx* monosepalous, tubular, the lobes with a valvate or separate æstivation, their sinuses sometimes lengthened into other [illegible] *Petals* inserted between the lobes of the calyx, [illegible] deciduous, sometimes wanting. *Stamens* inserted into the tube of the calyx below the petals, to which they are sometimes equal in number; sometimes they are twice, or even thrice, and occasionally four times as numerous; *anthers* 2-celled, opening longitudinally. *Ovary* superior, 2- or 4-celled; *style* filiform; *stigma* usually capitate. *Capsule* membranous, covered by the calyx. *Seeds* numerous, small.—*Herbs*, rarely *shrubs*. *Branches* frequently 4-cornered. *Leaves* opposite, seldom alternate, entire, without either stipules or glands. *Flowers* axillary, or in terminal spikes or racemes.

*** No other European plants have a tubular strongly ribbed calyx, below the sinuses of which the petals are inserted, and stamens growing to the tube of the calyx some distance below the insertion of the petals.

LYTHRUM.

Calyx cylindrical, striated, with 8 to 12 teeth, of which 4 to 6 are broader than the rest and erect, the others smaller and spreading. Petals 4 or 6, inserted into the orifice of the calyx, opposite the smaller lobes of the calyx. Stamens situated in the middle or at the base of the calyx, twice as numerous as the petals, or occasionally fewer. Capsule oblong, 2-celled, many-seeded, included in the calyx.—Erect herbaceous plants. Leaves opposite. Stems square. Flowers purple, axillary.

Fig. CXXXI. *c*.—Lythrum Salicaria.

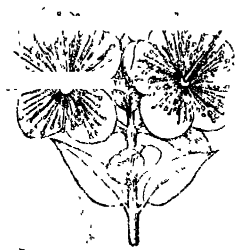
1. *L. Salicaria.* Leaves opposite, lanceolate; heart-shaped at the base. Flowers in whorled leafy spikes. Stamens 12.——*Ditches and meadows.* Flowers large, purple.

ORDER XXVI. MYRTACEÆ.—MYRTLE BLOOMS.

ESSENTIAL CHARACTER.—*Calyx* superior, 4- or 5-cleft. *Petals* equal in number to the segments of the calyx, with a quincuncial æstivation. *Stamens* twice as many as the petals, or indefinite. *Ovary* inferior, 4- 5- or 6-celled; *style* simple; *stigma* simple. *Fruit* fleshy. *Seeds* usually indefinite, variable in form.—*Trees* or *shrubs.* *Leaves* opposite or alternate, entire, with transparent dots, and usually with a vein running parallel with their margin. *Inflorescence* variable, usually axillary.

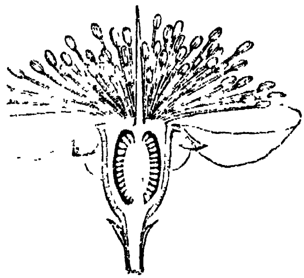
*** The dotted leaves and inferior ovary distinguish Myrtaceæ among European plants, and are often not a bad mark of distinction in other countries.

Tube of the calyx roundish; the limb 5-parted. Petals 5. Stamens distinct. Fruit, a 2- or 3-celled juicy berry, crowned by the limb of the calyx.



1. Fig. CXXXII

1. M. *commu-nis.* Peduncles solitary, 1-flowered, rather shorter than the leaf. Bracts 2, linear, deciduous, below the flower. Leaves ovate or lanceolate, acute. ———*Gardens* Common in the warm parts of the South of Europe.



F. CXXXIII

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ORDER XXVII. CRASSULACEÆ.—HOUSELEEKS.

ESSENTIAL CHARACTER.—*Sepals* 5 or 6. *Petals* the same number, [re]gular, and sharp-pointed. *Stamens* inserted with the petals, either equal [to] them in number and alternate with them, or twice as many, those oppo[s]ite the petals being shortest, and arriving at perfection after the others. *Hypogynous scales* several, 1 at the base of each carpel. *Ovaries* of the same number as the petals, opposite to which they are placed, 1-celled, tapering into stigmas. *Fruit* consisting of several follicles, opening by the suture in their face. *Seeds* attached to the margins of the suture.—Succulent *herbs* or *shrubs.* *Leaves* entire or pinnatifid: *stipules* none. *Flowers* usually in cymes, sessile, often arranged unilaterally along the division of the cymes.

*** The peculiarly regular alternation of all the parts of the flower, and the separation of the carpels, which look like petals rolled up, distinguish these plants from all others belonging to the Flora of Europe, especially if the succulent leaves are taken into account. It is to be remarked that the corolla is sometimes monopetalous.

Fig. CXXXII.—Myrtus communis. Fig. CXXXIII.—A perpendicular section of its flower.

RHODIOLA.

Flowers by abortion dioecious. Calyx 4-parted. Petals 4. Stamens 8. Carpels 4, capsular, many-seeded.

1. R. *rosea*. Leaves oblong, serrated at the tip, smooth. Root fleshy. Stem simple. ———*Rocks and woods.* Calyx purple. Petals yellowish.

SEMPERVIVUM.

Sepals from 6 to 20, slightly cohering at the base. Petals, the same number, acuminate. Stamens twice as numerous as the petals. Hypogynous scales lacerated. Fruit of as many parts as there are petals.— Herbaceous perennial plants or shrubs; propagated by offsets arising from the axils of the leaves. Leaves thick, fleshy. Flowers in cymes, corymbs, or panicles, white, yellow, or purple.

1. S. *tectorum* (*Houseleek*). Leaves fringed, offsets spreading. Edges of the petals hairy, entire.————*Roofs of cottages and sheds.*

SEDUM.

Sepals 5, cohering at the base, turgid, and often leafy. Petals 5, spreading. Stamens 10. Hypogynous scales entire. Fruit in 5 parts.—Herbs with fleshy leaves, many branches, and cymose flowers.

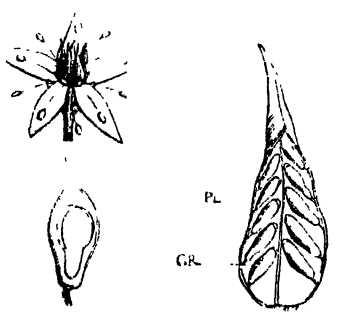
Fig. CXXXIII. *b*.

Fig. CXXXIII. *b*.—Sedum Telephium, the purple variety

1. S. *Telephium* (*Orpine*). Leaves flattish, serrated. Corymb leafy. Stem erect. ——*Mountainous woods.* Varies with leaves and flowers either green or purple.

Fig CXXXIV.

1. S. *acre* (*Stonecrop*). Leaves alternate, early ovate, thick, tumid, spurred at the base. Cyme of three smooth branches, leafy.——*Old walls.* Flowers yellow.
2. S. *album*. Leaves ob- - - - - obtuse, spreading. Cyme much branched, smooth. Petals lanceolate.——*Old walls.* Flowers white.



ORDER XXVIII. GROSSULARIACEÆ—CURRANTWORTS.

ESSENTIAL CHARACTER.—*Calyx* superior, 4- or 5-parted, regular. *Petals* 5, minute, inserted in the throat of the calyx. *Stamens* 5, inserted alternately with the petals, very short. *Ovary* 1-celled, with 2 opposite parietal placentæ; *ovules* numerous; *style* 2- 3- or 4-cleft. *Berry* crowned with the remains of the flower, 1-celled; the cell filled with pulp. *Seeds* numerous, suspended among the pulp by long filiform cords; *testa* externally gelatinous, adhering firmly to the *albumen; embryo* minute.—*Shrubs*, either unarmed or spiny. *Leaves* alternate, lobed, with a plaited vernation. *Flowers* in axillary racemes, with bracts at their base, rarely unisexual.

Fig. CXXXIV.—Sedum acre. 1. A flower; 2. a ripe carpel, after dehiscence, with seeds (*gr*) sticking to the placentæ (*pl*) on its edges; 3. a section of a seed.

RIBES.

The character the same as that of the order; this being the only genus.

1. R. *rubrum* (*The Red Currant*). No prickles. Clusters smooth, pendulous. Flowers but slightly concave. Petals inversely heart-shaped. ——— *Woods and gardens.*

2. R. *nigrum* (*The Black Currant*). No prickles. Clusters hairy, pendulous, with a separate flower-stalk at the base of each. Flowers oblong. ——— *Gardens.*

3. R. *Grossularia* (*The Gooseberry*). Prickles 1, 2, or 3 under each bud. Branches otherwise smooth, spreading. Stalks single-flowered. Bracts close together. Segments of the calyx reflexed, shorter than the tube ——— *Hedges and gardens.*

ORDER XXIX. SAXIFRAGACEÆ—SAXIFRAGES

ESSENTIAL CHARACTER.—*Calyx* either superior or inferior, of 4 or 5 sepals, which cohere more or less at their base. *Petals* 5, *Stamens* 5-10; *anthers* 2-celled, bursting longitudinally. *Disk* either hypogynous or perigynous, sometimes nearly obsolete, sometimes annular and notched. *Ovary* inferior, or nearly superior, consisting of 2 carpels, cohering more or less by their face, but distinct and diverging at the apex. *Stigmas* sessile on the tips of the lobes of the ovary. *Fruit* generally a membranous 1- or 2-celled capsule, with the cells divaricating when ripe. *Seeds* numerous, very minute.—*Herbaceous* plants, often growing in patches. *Leaves* simple, either divided or entire, alternate, without stipules. *Flower-stems* simple, often naked.

*** All European plants with polypetalous flowers, and two divaricating many-seeded carpels, belong to this order, which is otherwise much like Rosaceæ.

Calyx 5-lobed, erect. Petals equal. Stamens 10, perigynous. Disk obsolete. Capsule half inferior, with 2 cells. Stamens generally branching, and forming tufts, sometimes simple. Leaves usually divided more or less. Flowers white or purple, seldom yellow.

1. S. *granulata*. Leaves kidney-shaped, lobed. Stem panicled, leafy. Root granulated.———*Hedgerows.* Flowers white.

ROBERTSONIA.

Calyx 5-leaved, reflexed. Petals equal, or nearly so. Stamens 10, hypogynous. Disk obsolete. Calyx superior, with 2 cells. Seeds globose.— Stems branching and forming dense tufts. Leaves broad, notched, often cartilaginous at the edge. Flowers white or pink, rarely pale yellow.

1. R. *umbrosa* (*London Pride*). Leaves obovate, retuse, quite smooth, with cartilaginous crenatures, when full grown spreading. Petioles short, dilated. Pedicels few-flowered.— —— *Irish mountains. Gardens.* Flowers rather pink.

ORDER XXX. APIACEÆ—UMBELLIFERS.

ESSENTIAL CHARACTER.—*Calyx* superior, either entire or 5-toothed. *Petals* 5, inserted on the outside of a fleshy epigynous disk; usually inflexed at the point. *Stamens* 5, incurved in æstivation. *Ovary* inferior, 2-celled; crowned by a double fleshy disk; *styles* 2, distinct; *stigmas* simple. *Fruit* consisting of 2 carpels, separable from a common axis, to which they adhere by their face (*the commissure*); each carpel traversed by elevated *ridges*, of which 5 are primary, and 4, alternating with them, secondary; the ridges are separated by *channels*, below which are often placed, in the substance of the pericarp, certain linear

receptacles of coloured oily matter called *vittæ*.—*Herbaceous* plants, with

Fig. CXXXV.

fistular furrowed stems. *Leaves* usually sheathing at the base. *Flowers* in umbels.

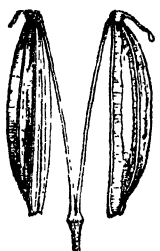


Fig CXXXVII.

The flowers growing in umbels, the superior petals turned in at their points, and the inferior fruit, which splits into halves, commonly remaining of themselves sufficient to distinguish

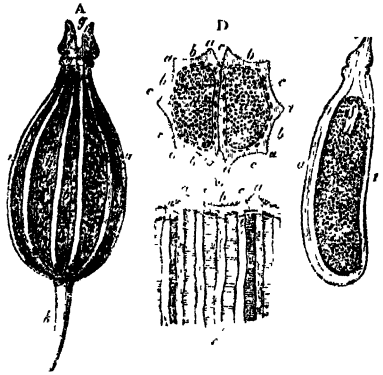


Fig CXXXVI.

HYDROCOTYLE.

Calyx an obsolete margin. Fruit compressed at the side, so as to form 2 little shields. Carpels with 5, filiform ridges, those of the keel and sides nearly obsolete, the intermediate arched, without vittæ.—Creeping herbs, with simple leaves, and green obscure flowers.

1. H. *vulgaris* (*Sheeprot*). Leaves orbicular, peltate, smooth.———*Bogs and marshes.* A small stemless creeping plant, with the greenish-yellow flowers hidden below the leaves.

APIUM.

Calyx an obsolete margin. Petals roundish, entire, with an involute point. Fruit roundish, contracted at the sides, double. Carpels with 5, filiform equal ridges, of which the lateral form a margin. Channels with single vittæ, except the outermost, which have sometimes 2 or 3.—Involucre none. Flowers white.

1. A. *graveolens* (*Celery*). Leaflets of the stem-leaves wedge-shaped. Stem furrowed.——— *Marshes. Gardens.*

PETROSELINUM.

Calyx an obsolete margin. Fruit ovate, contracted at the side, nearly double. Carpels with 5, equal, filiform ridges, of which the lateral form a margin. Channels with single vittæ.—Universal involucre few-leaved; partial many-leaved.

1. P. *sativum* (*Parsley*). Stem erect, angular. Leaves shining, tripinnate, with the lower leaflets ovate-cuneate, trifid and toothed, the upper ternate, lanceolate, entire, and trifid. ———*Gardens.*

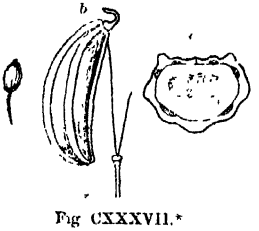


Fig CXXXVII.*

ÆGOPODIUM.

Calyx an obsolete margin. Fruit compressed at the side, oblong. Carpels with 5, filiform ridges, of which the lateral form a margin. Channels without vittæ. Involucre none.

1. *Æ. Podagraria* (*Goutweed*). Stem deeply furrowed. Leaves biternate and ternate; leaflets lanceolate-ovate, acuminate.———*Hedgerows.*

Fig. CXXXV.—A flower of an umbellifero plant.

Fig. CXXXVI.—Fruit of common Anise.- A. a perfect and ripe fruit; *g.* the epigynous disk: *a a.* primary ridges; *b.* pedicel; *b b.* channels; C. a perpendicular section of one half; *g.* disk; *f.* embryo; *a.* back; *s* commissure; *d.* albumen; D a cross section of A.; *a* and *b.* as before; *c.* vittæ; E a portion of the rind of the fruit more magnified, *a. b c* as before.

Fig. CXXXVII.—Two lobes of the fruit of Angelica, adhering to their double axis or carpophore.

Fig. CXXXVII.*—*a.* Fruit of Petroselinum, natural size; *b.* a half fruit magnified; *c.* a cross section of the same.

ŒNANTHE.

Calyx 5-toothed. Petals obovate, emarginate, inflexed. Fruit nearly taper, crowned by the erect styles. Carpels with 5, rather convex, obtuse ridges, of which the lateral form a margin, and are rather broader than the others. Channels with single vittæ. Axis wanting.—Universal involucre wanting; partial many-leaved. Flowers white.

1 Œ. *crocata* (*Water Dropwort*). Leaflets all wedge-shaped, many-cleft, nearly uniform. Fruit linear-oblong, with slender ridges. ——*Ditches and meadows.* One of our most dangerous poisons. Its leaves have always a very dark green colour

2. Œ. *fistulosa*. Root sending forth runners. Stem-leaves pinnate, cylindrical, tubular. Universal involucre mostly wanting. ——*Marshes and ponds.*

Fig CXXXVIII.

FŒNICULUM.

Calyx obsolete. Petals roundish entire, with a nearly square, retuse, involute segment. Fruit nearly taper. Carpels with 5, prominent, obtusely keeled ridges, of which the lateral form a margin, and are rather broader than the others. Channels with 1 vitta. — Involucre none Flowers yellow.

1. F. *officinale* (*Fennel*). Stem round at the base. Leaves cut into very fine capillary segments. Involucre none. — ——*Gardens.*

Calyx almost obsolete. Petals roundish, entire, involute, with a broad, inflexed, blunt, middle segment. Fruit flattened at the back, surrounded by a dilated flat margin. Carpels with very fine ridges; the 3 dorsal equidistant, the 2 lateral contiguous to the dilated margin. Channels with single vittæ.—Involucre neither universal nor partial, or with very few leaves. Flowers yellow.

1. P. *sativa* (*Parsnep*). Leaves simply pinnate; downy beneath, with ovate-oblong, or oblong-obtuse, crenated leaflets, of which the lateral are lobed at the base.——*Gardens.*

TORILIS.

Calyx 5-toothed. Petals obovate, emarginate, inflexed; the outer larger than the others, and bifid. Fruit contracted at the side. Carpel with the 5 primary ridges bristly, of which the 3 middle are dorsal, and the 2 lateral ones in the plane of the commissure; the secondary ridges obliterated by the multitude of prickles which cover the channels. Channels under the prickles with single vittæ.—Involucre variable; the partial many-leaved. Flowers white or pink.

1. T. *Anthriscus*. Umbels of many close rays. General involucre many-leaved. Leaflets pinnatifid. Branches nearly upright. ——*Hedgerows.*

Fig CXXXVIII.—Œnanthe crocata.

ASTRANTIA.

Calyx with leafy teeth. Petals erect, with the point very long and bent inwards. Carpels compressed from the back, with 5 raised, inflated, plaited and toothed ridges, having between them smaller fistular ridges. Vittæ 0 ——. Involucre large, leafy, coloured, longer than the umbels, which are simple.

1. A. *major*. Radical leaves palmate, 5-parted, with obovate acute unequally cut segments. Leaves of involucre entire or with 1—2 teeth at the end. Teeth of calyx acuminate mucronate. ———— *Gardens. G. carry. &c.* Leaves of the involucre pink.

ERYNGIUM.

Calyx with leafy teeth. Petals erect, with the point very long and bent inwards. Fruit terete, obovate, covered with scales or tubercles; the carpels destitute both of ridges and vittæ.——Flowers capitate. Involucre very long, spiny, usually blue or green.

N.B. The student will remark that in this genus the flowers are not umbellate, but capitate: being perfectly sessile upon a fleshy receptacle, exactly as in Composites, p. 81.

1. E. *maritimum* (*Sea Holly*). Leaves ternate, bipinnatifid, with netted veins and spiny teeth; the radical petiolate, the cauline auriculate and stem-clasping lacerated. Stem panicled, straggling. Involucres blue, longer than the round flower-heads.——*Sandy sea coast.* Roots, when boiled in sugar, form candid Eryngo root, a rather agreeable aromatic sweetmeat.

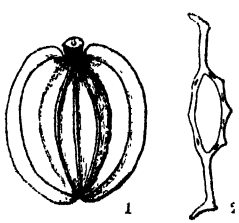


Fig. CXXXVIII *b*.

BUPLEURUM.

Calyx obsolete. Petals roundish, entire, closely rolled up, with a broad inflexed point. Fruit compressed from the side, or almost didymous. Carpels with 5 equal acute winged ridges, or with scarcely any; those at the side forming an edge. Channels with or without vittæ. Albumen flat in front.——Flowers yellow. Leaves perfectly undivided.

Fig. CXXXVIII. *b* — Pastinaca sativa; 1 Its fruit seen from the back, magnified; 2. its transverse section.

1. B. *fruticosum*. Shrubby, erect, branched. Leaves evergreen, oblong, leathery, shining, sessile. Bracts of the involucre oblong.——*Common in gardens, especially on the chalky cliffs of the South coast. South of Europe.* A small but beautiful evergreen bush, remarkable for withstanding the action of the sea breezes.

2. B. *rotundifolium* (*Thorough-wax*). An annual. Leaves perfoliate, roundish oval. Channels of fruit striated.——*Cornfields in the autumn, here and there.* The vulgar name seems to have been derived from the peculiar appearance of the stem, which seems as if it grew through (or thorough) the leaves; from the old English verb to "wax," to "grow."

DAUCUS.

Fruit lenticular, compressed from the back. Carpels with 4 secondary ridges which are of equal size, winged, and completely broken up into prickly teeth.

Fig. CXXXVIII. *c*.

1. D. *Carota* (*The Common Carrot*). A biennial, with a fleshy tap-root. Stem hispid. Leaves 2—3-pinnate, not at all shining, with pinnatifid pinnules whose lobes are lanceolate and cuspidate. Leaflets of the involucre trifid and pinnatifid, as long as the umbel.——*Common in fields and pastures.* Flowers white or tinged with pink. Undoubtedly the wild state of the Garden Carrot.

SMYRNIUM.

Fruit contracted at the side. Carpels reniform-globose, didymous, with 3 principal sharp primary ridges, and two less evident ones at the edge. Channels with numerous vittæ. Albumen involute.

1. S. *Olusatrum* (*Alexanders*). A perennial. Stem angular and furrowed. Leaves of stem ternate, with a broad sheathing base; leaflets large, broadly ovate, lobed and serrated——*Waste places.* Formerly grown in gardens, as Celery now is. Flowers greenish, in very close umbels.

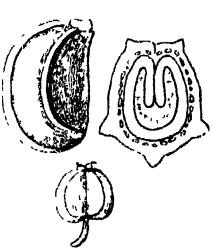


Fig CXXXVIII. *d*.

Fig. CXXXVIII. *c*.—Daucus Carota; 1 a flower of the ray; 2. a transverse section of a carpel—both magnified.

Fig. CXXXVIII. *d*.—Carpels of Smyrnium Olusatrum.

ÆTHUSA.

Calyx obsolete. Petals obovate, emarginate, inflexed. Fruit roundish-ovate. Carpels with 5, elevated thick, acutely keeled ridges of which the lateral form a margin, and are rather wider than the others, surrounded by a somewhat winged keel. Channels with one vitta.—Universal involucre wanting; partial 3-leaved, pendulous. Flowers white.

Fig. CXXXIX.

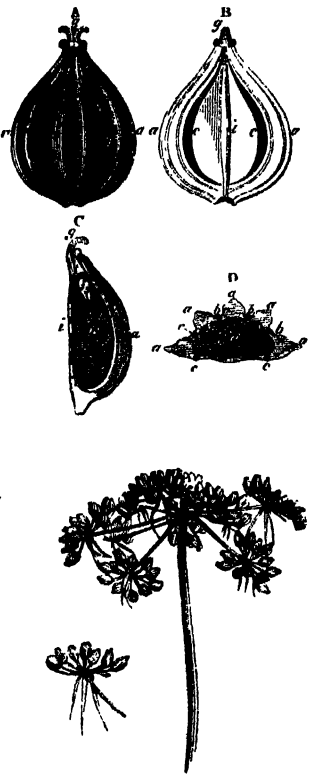


Fig. CXL.

1. *Æ. Cynapium* (*Fool's Parsley*). Leaves uniform; leaflets wedge-shaped, decurrent, with lanceolate segments. — ——*Waste Places.* Another very poisonous species. It is readily known by its one-sided involucre and corky-ribbed fruit

HERACLEUM.

Calyx 5-toothed. Petals obovate, emarginate, inflexed; the outer often radiant and bifid. Fruit flattened at the back, surrounded by a flat dilated margin. Carpels with very minute ridges; the 3 dorsal equidistant, the two lateral contiguous to the dilated margin. Channels with single clavate vittæ.—Universal involucre deciduous; partial many-leaved. Flowers large, white.

1. H. *Sphondylium* (*Cow Parsnep*). Leaves pinnate; leaflets pinnatifid, cut and serrated. Ovary downy. Fruit oval, obtuse, emarginate, smooth.———*Roadsides, hedge-rows, &c.*

Fig. CXL. *b*

Fig. CXXXIX.—Æthusa Cynapium. Fig. CXL. *b*—Fruit of Heracleum Sphondylium, with vittæ.
Fig. CXL.—The same in fruit. A. ripe fruit, B a half fruit or mericarp seen on the side of the commissure; C. a perpendicular section of a mericarp; D. a transverse do. In these figures the letters signify—*a* ridge, *b*. channel, *c*. vittæ, *d*. albumen, *f*. embryo, *g*. remains of styles.

SCANDIX.

Calyx an obsolete margin. Petals obovate, truncate, inflexed. Fruit compressed at the side, with a very long beak. Carpels with 5, obtuse, equal ridges, of which the lateral form a margin. Channels without vittæ, or with scarcely any.—Universal involucre none, or few-leaved; partial 5- or 7-leaved. Flowers white.

1. S. *Pecten* (*Venus's Comb*). Fruit nearly smooth, with a bristly-edged beak. Umbels simple; solitary or in pairs. Leaflets of the involucre jagged. Petals inflexed at the point.———*Hedges and woods.*

Calyx an obsolete margin. Petals obovate, emarginate, inflexed. Fruit compressed at the side, ovate. Carpels with 5, prominent, wavy, crenated, equal ridges, of which the lateral form a margin. Channels with many streaks, but no vittæ.—Universal involucre few-leaved; partial 3-leaved, halved.

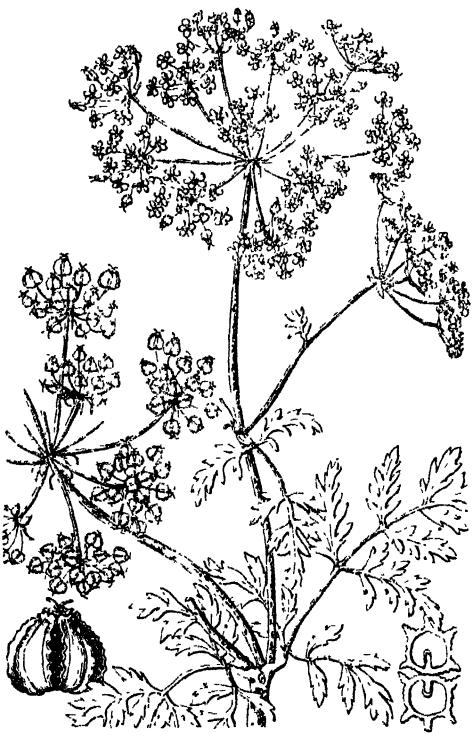


Fig. CXLI.

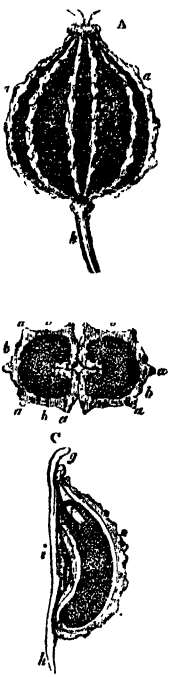


Fig. CXLII.

1. C. *maculatum* (*Hemlock*). Stem polished and spotted, much branched. Leaves decompound. Leaflets of the involucels lanceolate, shorter than the partial umbels. ——— *Fields, hedges, and roadsides.* A valuable medical plant, but also a dangerous narcotic poison.

N.B.—The beautiful figures CXXXIX., CXL., and CXLI., are taken, with the kind permission of Mr. Bell, from an excellent paper on the distinction of Anise, Fool's Parsley, and Conium, by Dr. Pereira, in the Pharmaceutical Journal.

Fig. CXLII.—A. ripe fruit seen from the side, C. longitudinal section of a mericarp; D. transverse section of the whole fruit, *a*. ridge, *b* channel, *d*. albumen. *f*. embryo, *g*. remains of the styles *i*. axis.

CORIANDRUM.

Calyx 5-toothed. Fruit globular. Carpels with 5 primary depressed wavy ridges and 4 more projecting straight ones. Vittæ none, except on the commissure. Albumen excavated, covered with a loose testa.

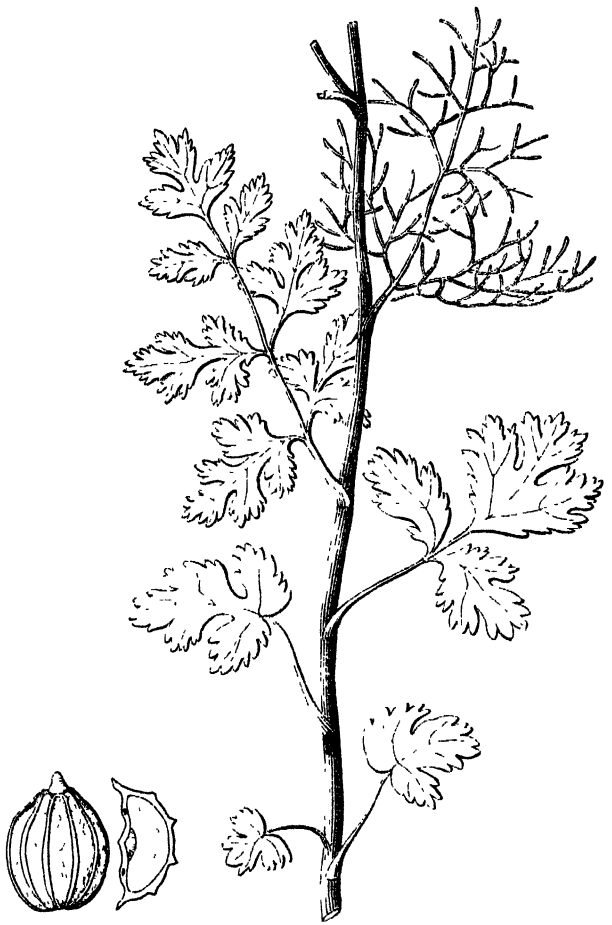


Fig. CXLII *b*.

1. *C. sativum* (*Coriander*). An annual. Lower leaves 3-lobed, toothed, or variously lobed; secondary leaves pinnate, with oblong pinnatifid serrated lobes; upper leaves supradecompound, filiform.——*Fields and waste places.* Flowers white. The whole plant smells strongly of bugs.

N.B.—This plant offers a valuable illustration of the changes in form undergone by leaves, in the progress of developement; and is of itself a proof of the truth of the views of morphologists, and of the doubtful importance of mere forms of foliage in distinguishing the species of plants. Of this the young student cannot be too often made aware.

Fig. CXLII. *b* —Coriandrum sativum, with its fruit at the side magnified, and a cross section of a carpel

ANTHRISCUS.

Calyx an obsolete margin. Petals obovate, truncate, or emarginate, inflexed, often very short. Fruit contracted at the side, beaked. Carpels almost taper, without ridges, the beak only having 5.—Universal involucre none ; partial, many-leaved. Flowers white.

1. A. *sylvestris.* Umbels terminal, stalked. Leaflets of the involucre ovate, membranous. Leaves triply pinnate; leaflets ovate, pinnatifid, rough-edged. ——— *Hedges and woods.*

CHÆROPHYLLUM.

Calyx an obsolete margin. Petals obovate, emarginate, inflexed Fruit compressed, or contracted at the sides. Carpels with 5, obtuse, equal ridges, of which the lateral form a margin, the commissure with a deep furrow. Channels with a single vitta. —Universal involucre wanting, or few-leaved ; partial of several leaflets. Flowers white.

1. C. *nodosum.* Stem swollen under the nodes. Leaves ternate, bipinnate ; leaflets ovate, pinnatifid, cut and toothed. Fruit hispid. Stigma subsessile.——*Hedges.*

2. C. *temulum.* Fruit nearly smooth. Stem rough, swollen under each joint. Leaflets pinnatifid, with blunt lobes. Styles recurved, as long as the disk.———

The following are additional natural orders of this sub-class, included in the European Flora, but consisting of only a small number of species, and of less importance than the preceding.

Fig CXLII *c*.

Fig CXLII *c*.—Hedera Helix ; the common Ivy, in flower

ARALIACEÆ—IVYWORTS, OR ARALIADS.

ESSENTIAL CHARACTER.—*Calyx* superior, entire, or toothed. *Petals* definite, 5 to 10, deciduous, valvate in æstivation, occasionally absent. *Stamens* equal in number to the petals, or twice as many, arising from within the border of the calyx, and from without an epigynous disk. *Ovary* inferior, with more cells than 2; *ovules* solitary, pendulous; *styles* equal in number to the cells, sometimes connate; *stigmas* simple. *Fruit* succulent or dry, consisting of several 1-seeded cells. *Seeds* solitary, pendulous, adhering to the pericarp. *Trees*, *shrubs*, or *herbaceous* plants, with the habit of Umbellifers.

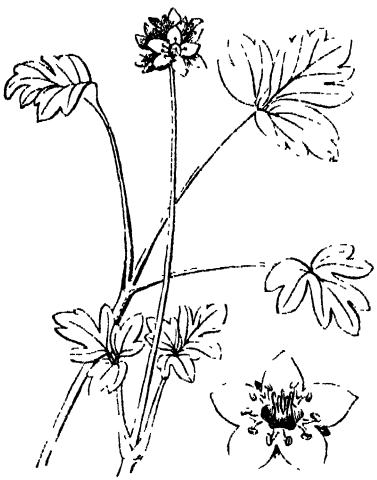


Fig CXLIII.

*** The *Ivy* (*Hedera Helix*) and the *Moschatel* (*Adoxa Moschatellina*) are the only two European plants of this order, which differs from Umbellifers chiefly in having valvate petals, and more cells to the ovary than 2.

PORTULACACEÆ.—PURSLANEWORTS.

ESSENTIAL CHARACTER.—*Sepals* 2. *Petals* 5. *Stamens* 5, or fewer, and opposite the petals to which they adhere, or indefinite in number, and distinct. *Ovary* superior, 1-celled, many-seeded, with a few central placentæ. *Fruit* capsular.—*Herbaceous* plants with inconspicuous flowers. *Leaves* succulent, without stipules.

*** *Common Purslane* (*Portulaca oleracea*), and two or three obscure weeds, are the only European species of this order, which is precisely marked by its 2 sepals, 5 petals, and superior 1-celled many-seeded ovary, with a free central placenta.

HALORAGEÆ—HIPPURIDS.

ESSENTIAL CHARACTER.—*Calyx* superior, with a minute limb. *Petals* minute, or wanting. *Stamens* equal in number to the petals, or occasionally fewer. *Ovary* adhering inseparably to the calyx, with 1 or more cells; *style* none; *stigmas* equal in number to the cells; *ovules* pendulous. *Fruit* dry, indehiscent, membranous, or bony, with 1 or more cells. *Seeds* solitary, pendulous.—*Herbaceous* plants or *under-shrubs*, often growing in wet places. *Leaves* either alternate, opposite, or whorled. *Flowers* axillary, sessile, occasionally monœcious or diœcious.

*** Weeds, usually inhabiting wet places. *Hippuris vulgaris* (*the Horsetail*) and *Myriophyllum* are the principal European forms. The order is, probably, a mere degeneration of Onagraceæ, to which it certainly is nearly allied.

Fig. CXLIII.—Adoxa Moschatellina. It is to be observed that the petals of this plant often grow together at the base, so as to form a monopetalous corolla, on which account, and as it is difficult to discover in a natural arrangement, it is here figured.

RESEDACEÆ—WELDWORTS.

ESSENTIAL CHARACTER.—*Calyx* many-parted. *Petals* lacerated, unequal. *Disk* hypogynous, one-sided, glandular. *Stamens* definite; *filaments* erect; *anthers* 2-celled, opening longitudinally. *Ovary* sessile, 3-lobed, 1-celled, many-seeded, with 3 parietal placentæ; *stigmas* 3, glandular, sessile. *Fruit* dry and membranous, or succulent, opening at the apex. *Seeds* several, reniform, attached to 3 parietal placentæ.—*Herbaceous* plants with alternate *leaves*, the surface of which is minutely papillose; and minute, gland-like *stipules*.

*** The garden *Mignonette* (*Reseda odorata*), and the common wild flowers *Reseda Luteola*, or Weld, and *R. lutea*, are representatives of this curious but inconsiderable order. Weld is a common annual, employed in making a yellow dye.

CHAPTER VI.

OF COROLLIFLORAL EXOGENS

The following are the principal orders of this sub-class, viz. :—

Cucurbitaceæ*; Cornaceæ; Caprifoliaceæ; Stellatæ; Valerianaceæ; Dipsaceæ; Compositæ*; Campanulaceæ*; Ericaceæ*; Primulaceæ; Gentianaceæ; Convolvulaceæ; [illegible]; Labiatæ; Solanaceæ; Scrophulariaceæ; Lentibulariaceæ; Plantaginaceæ; Plumbaginaceæ.

The differences between these orders are shown in the following short characters :—

Cucurbitaceæ.—Flowers unisexual. Sepals, petals, and stamens, 5 each. Carpels united into an inferior 1-celled ovary, with 3 parietal placentæ Fruit fleshy.

Cornaceæ.—Sepals, petals, and stamens, 4 each. Carpels united into an inferior, 2-celled ovary, with solitary pendulous ovules, and a single style. Fruit a drupe. Stem round

Caprifoliaceæ.—Sepals, petals, and stamens, 5 each. Carpels united into an inferior 1-3-celled ovary. Fruit not a drupe.

Stellatæ.—Sepals, petals, and stamens, 4 or 5 each. Carpels united into an inferior 2-celled ovary, with solitary peltate ovules, and 2 styles. Stem angular.

Valerianaceæ.—Calyx with a membranous or pappose† limb, and naked Anthers distinct. Ovary solitary, inferior, with one pendulous ovule.

Dipsaceæ.—Calyx with a membranous or pappose limb, and enclosed in an involucel. Anthers distinct. Ovary solitary, inferior, with one pendulous ovule.

Compositæ.—Calyx with a membranous or pappose limb. Anthers united Ovary solitary, inferior, with one erect ovule

Campanulaceæ.—Sepals, petals, and stamens, 5 each. Filaments broad, and valvate at the base. Ovaries united into an inferior, many-celled, many-seeded pistil, with a thick hairy style.

Ericaceæ.—Sepals, petals, and stamens, 4 or 5; the latter hypogynous. Anthers opening by pores. Carpels united into a superior, many-celled, many-seeded pistil.

Primulaceæ.—Sepals, petals, and stamens, 5 each; the latter opposite the petals. Carpels united into a superior, 1-celled, many-seeded pistil, with a free central placenta.

Gentianaceæ.—Sepals, petals, and stamens, four or five. Carpels united into a superior, 1-celled, many-seeded pistil, with parietal placentæ. Leaves ribbed, and opposite.

Convolvulaceæ. Sepals, petals, and stach; the first imbricated distinctly in 2 rows. Carpels united into a superior, 2- or 3-celled, few-seeded, pistil, with erect ovules

Boraginaceæ.—Sepals, petals, and stamens, 5 each; regular. Carpels united into a superior, 4-lobed ovary. Four nuts.

Labiatæ.—Sepals and petals 5 each, bilabiate. Stamens 2 or 4. Carpels united into a superior, 4-lobed ovary. Four nuts.

Solanaceæ.—Sepals, petals, and stamens, 5 each. Carpels united into a superior, 2-celled, many-seeded pistil.

Scrophulariaceæ.—Sepals and petals 5 each, irregular. Stamens 2 or 4. Carpels united into a superior, 2-celled, many-seeded pistil.

Lentibulariaceæ.—Sepals and petals 4 or 5 each, irregularly united. Stamens 2. Carpels united into a superior pistil, with a free, central, many-seeded placenta.

Plantaginaceæ.—Sepals, petals, and stamens, 4 each; the corolla very thin and membranous. Carpel solitary, superior, 1- or 2-celled, with a unilateral stigma. Placenta free, central.

Plumbaginaceæ.—Sepals, petals, and stamens, 5 each; the first plaited. Ovary solitary, superior, 1 celled, with 5 stigmas. Placenta free, central with a solitary stalked ovule.

Tabular View of the preceding Natural Orders

A. *Ovary inferior.*

a. Ovary 1-celled, many-seeded, with parietal placentæ. Fruit pulpy. Flowers unisexual . . . *Cucurbitaceæ.*

b. Ovary 2-celled, with 1 style. Corolla valvate. Fruit drupaceous consolidated. Stem round . . *Cornaceæ.*

c. Ovary 2-celled, with 2 styles. Corolla valvate. Fruit composed of two distinct halves. Stem angular . *Stellatæ.*

d. Ovary 1- 3-celled, few-seeded. Filaments on the corolla. Leaves opposite. *Caprifoliaceæ.*

* The orders thus marked are not arranged in this class by De Candolle; but it seems to me better for the young student to regard the essential mark of Corolliflorals to reside in the Monopetalous Corolla.

† When a calyx has its border divided into bristles, or hairs, or thin colourless scales, or feathery plumes, it is called *pappus*, or said to be in a *pappose* state.

e. Ovary 3-celled (generally), many-seeded. Filaments valvate at the base of the corolla . *Campanulaceæ.*
f Ovary 1-celled.
α. Anthers syngenesious . *Compositæ.*
β. Anthers free. Calyx naked. *Valerianaceæ.*
γ. Anthers free. Calyx with an involucre . . . . *Dipsaceæ.*

B. *Ovary superior.*
a. Stamens hypogynous . . *Ericaceæ.*
b. Stamens epipetalous. Flowers unsymmetrical
α. Ovary 4-lobed . . . *Labiatæ.*
β. Ovary not lobed, 2-celled, many-seeded . . . *Scrophulariaceæ.*
γ. Ovary not lobed, with a free central placenta . . *Lentibulariaceæ.*
c. Stamens epipetalous. Flowers symmetrical.
α. Ovary 4-lobed . . *Boraginaceæ.*
β. Ovary with a free central placenta. Stamens opposite the petals. *Primulaceæ.*
γ. Ovary many-seeded, with 2 parietal placentæ . . . *Gentianaceæ.*
δ. Ovary many-seeded, with placentæ in the axis . . . *Solanaceæ.*
ε. Ovary 2- or 3-celled, few-seeded, with erect ovules. Sepals 2 on the outside of the 3 others. *Convolvulaceæ*
* Ovary with a free central placenta. Stigma unilateral. *Plantaginaceæ.*
η. Do. do. do. Ovule solitary, upon an ascending cord. Stigmas 5 . . *Plumbaginaceæ*

ORDER XXXI. CUCURBITACEÆ—CUCURBITS.

ESSENTIAL CHARACTER.—*Flowers* unisexual. *Calyx* 5-toothed. *Corolla* 5-parted, scarcely distinguishable from the calyx, very cellular, with strongly-marked reticulated veins. *Stamens* 5, either distinct, or cohering in 3 parcels; *anthers* 2-celled, very long and sinuous. *Ovary* inferior, 1-celled, with 3 parietal placentæ; *style* short; *stigmas* very thick, velvety, or fringed. *Fruit* fleshy, more or less succulent, crowned by the scar of the calyx, 1-celled, with 3 parietal placentæ. *Seeds* flat, ovate.—*Stem* succulent, climbing by means of tendrils. *Leaves* palmated, or with palmate ribs, very succulent, covered with numerous asperities. *Flowers* white, red, or yellow.

*** These are climbing plants, with fleshy fruit, and unisexual yellow or green flowers. The Melon, Gourd, and Cucumber, belong to the order.

CUCUMIS.

Calyx 5-toothed. Corolla 5-parted. ♂ Stamens 5; filaments in 3 parcels; anthers converging. ♀ Style short, trifid; stigmas bifid. Fruit with a thick tough fleshy rind, and numerous seeds.

1. C. *Melo* (*The Melon*). Stem covered with rough hairs, climbing. Tendrils simple. Leaves heart-shaped, with 5 angles, toothletted; the angles rounded. Fruit round, or oval, smooth, warted or netted. —— *Gardens.* A native of Persia. Its fruit is known everywhere.

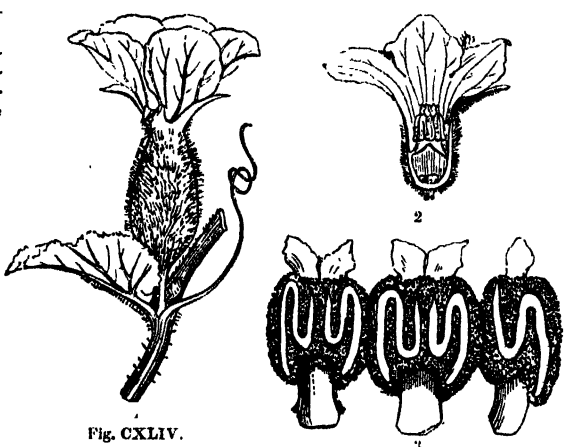


Fig. CXLIV.

Fig. CXLIV.—Cucumis Melo. 1 ♀ flower and leaf; 2. section of a ♂ flower, 3. the stamens, much magnified.

MOMORDICA.

Tendrils lateral. Stamens triadelphous. Anthers connate. Calyx of males short. Fruit covered with fleshy warts finally splitting and rolling its valves backwards.

1. M. *Balsamina* (*Balsam Apple*). Leaves palmate, toothed, smooth, shining. Fruit oblong, acuminate, with rows of oblong tubercles, separated by crowds of roundish ones.——— *Common in gardens. South of Europe, &c.* Fruit scarlet, a dangerous poison when ripe.

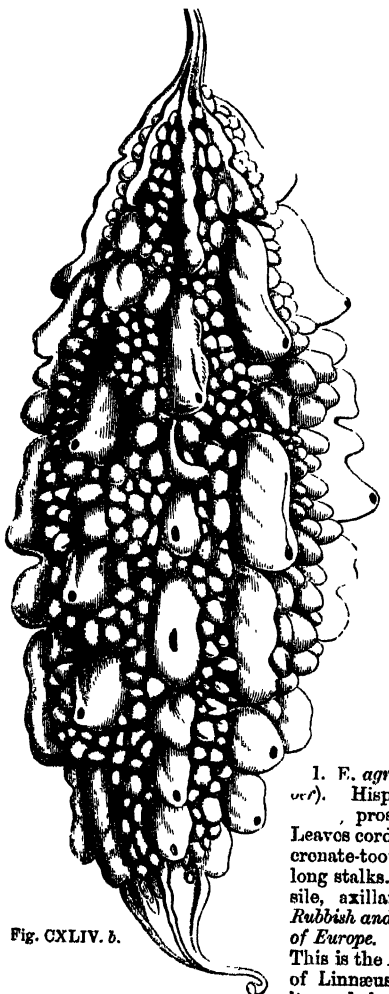


Fig. CXLIV. *b*.

ELATERIUM.

Stamens monadelphous. Anthers connate. Calyx of males campanulate. Fruit hispid, not splitting into valves, but expelling the seeds backwards with much force when ripe.

1. E. *agreste* (*Spirting Cucumber*). Hispid, scabrous. Stem prostrate, not climbing. Leaves cordate, somewhat lobed, crenate-toothed, very rough, on long stalks. Flowers nearly sessile, axillary. ——— *Gardens. Rubbish and old walls in the South of Europe.* A violent purgative. This is the *Momordica Elaterium* of Linnæus. The expulsion of its seeds backwards is a curious example of the force of what is called Endosmose.

Fig. CXLIV. *b*.—Fruit of Momordica Balsamina.

BRYONIA.

Flowers monœcious or diœcious. Petals scarcely cohering at the base.—♂ Calyx 5-toothed. Stamens in 3 parcels.—♀. Styles 3-fid. Fruit succulent, with small, ovate, compressed seeds, which are more or less bordered.—Tendrils simple.

1. B. *dioica* (*Bryony*). Leaves cordate, palmate, 5-lobed, toothed, with callous asperities; the terminal lobe longer. Flowers diœcious, in racemose corymbs.—*Hedges*. Root large, fleshy; an acrid poison. Flowers green. Berries red.

Fig. CXLIV *c*

ORDER XXXII. CORNACEÆ—CORNELS.

Essential Character.—*Sepals* 4, superior. *Petals* 4, oblong, broad at the base, inserted into the top of the calyx, regular, valvate in æstivation. *Stamens* 4, inserted along with the petals, and alternate with them; *anthers* ovate-oblong, 2-celled. *Style* filiform; *stigma* simple. *Drupe* berried, crowned by the remains of a calyx, with a 2-celled stone. *Seeds* pendulous, solitary.—*Trees* or *shrubs*, seldom *herbs*. *Leaves* opposite, entire or toothed, feather-veined. *Flowers* capitate, umbellate, or corymbose.

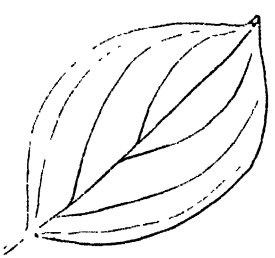


Fig. CXLV.

CORNUS.

Calyx 4-toothed, deciduous. Petals 4. Stamens 4. Drupe with a 2-celled nut. Erect deciduous shrubs or herbaceous plants, with simple leaves, and cymose or umbellate flowers.

1. C. *sanguinea* (*Dogwood*). Leaves green on both sides. Cymes naked, many-flowered, appearing with the leaves, without an involucre, flat —*Hedges* A deciduous shrub, with branches red in the winter. Flowers white.

2. C. *mascula*. (*The Cornel Tree* or *Cornelian Cherry.*) Young shoots downy. Leaves ovate, acuminate. Flowers small, yellow, in little

Fig. CXLIV *c*.—Bryonia dioica.

Fig. CXLV.—Leaf of Cornus sanguinea.

heads, enclosed in an involucre and appearing before the leaves.——*Shrubberies.* The austere fruit was formerly used in puddings and preserves. A small tree.

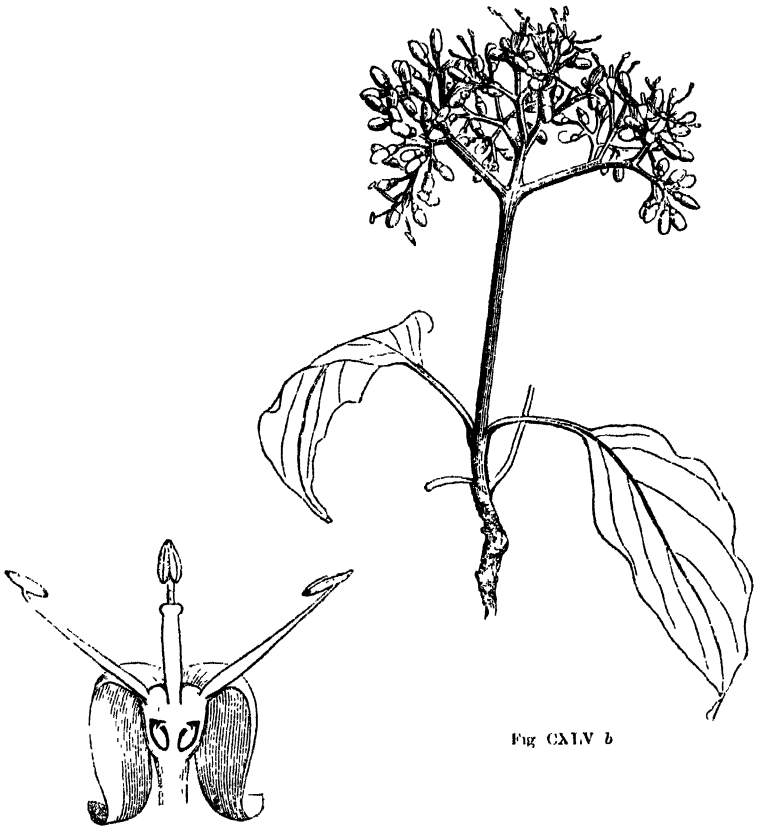


Fig. CXLV *b*

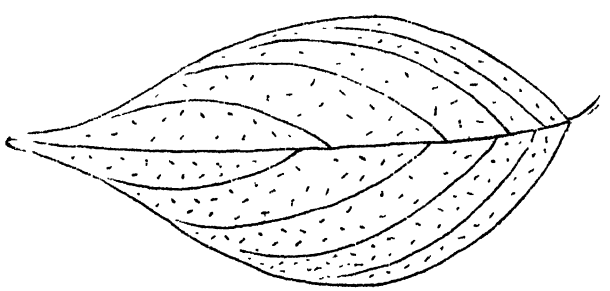
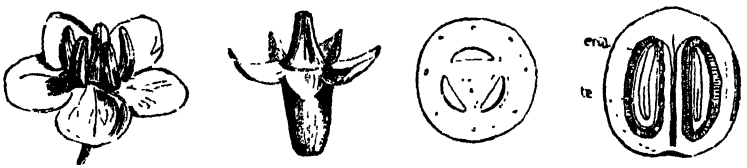


Fig. CXLVI.

Fig. CXLV. *b*.—Cornus sanguinea, with a perpendicular section of a flower magnified.
Fig. CXLVI.—Leaf of C. mascula.

ORDER XXXIII. CAPRIFOLIACEÆ—CAPRIFOILS.

ESSENTIAL CHARACTER.—*Calyx* superior, with a small limb. *Corolla*



1 2 Fig. CXLVII. 3 4

monopetalous, 4- or 5-cleft. *Stamens* inserted on the corolla, distinct, equal in number to its segments, and alternate with them. *Ovary* 1-3-celled, with one ovule in one cell, and several pendulous ones in the two others. *Fruit* succulent. — *Trees, shrubs,* or *herbaceous* plants. *Leaves* opposite, without stipules. *Flowers* usually in cymes, or in few-flowered clusters :— sometimes grown together at the base.

SAMBUCUS.

Calyx 5-cleft. Corolla rotate, 5-lobed. Stamens 5. Berry 3-seeded. Upright deciduous shrubs, with cymose flowers and pinnated leaves.

1. S *nigra* (*The Elder Tree*). Cymes with 5 main branches. Stipules obsolete. Leaflets ovate. Stem arboreous. ——— *Hedges and woods.* Fruit succulent, rich purple. Employed for making wine.

VIBURNUM.

Calyx 5-cleft. Corolla campanulate. 5-lobed. Stamens 5. Fruit succulent, 1-seeded.—Upright deciduous shrubs, with cymose flowers, and simple leaves.

Fig. CXLVIII.

1. V. *Tinus* (*The Laurustine*). Leaves ovate-oblong, entire, evergreen ; axils of the veins bearded underneath.——*Gardens.*

2. V. *Lantana* (*Wayfaring Tree*). Leaves rugose, heart-shaped, serrated, veiny ; downy beneath.——*Woods and gardens.*

Fig. CXLVII.—Sambucus nigra. 1. an expanded flower ; 2. the ovary, calyx, and style ; 3. a cross section of the ovary ; 4. a vertical section of the ripe fruit : *end.* the endocarp, or bony lining of the cells ; *te.* the testa or skin of the seed.

Fig CXLVIII —The same plant in fruit.

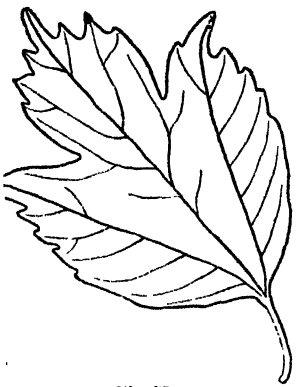


Fig. CL.

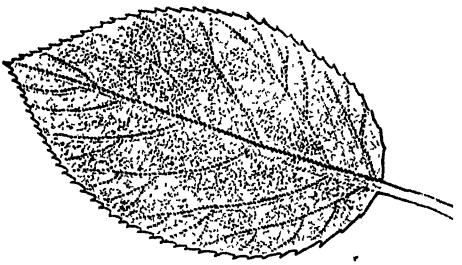


Fig. CXLIX.

3. V. *Opulus* (*The Guelder Rose*). Leaves lobed. Foot-stalks beset with glands. The exterior flowers radiant and neuter.———*Marshes.* The Snowball-tree of the Shrubberies is this plant: with all its flowers abortive, and expanded into broad white petals.

LONICERA.

Calyx 5-toothed, deciduous. Corolla funnel-shaped, saccate at the base, with an erect 2-lipped limb. Stamens 5. Ovary 3-celled, with the cells equally many-seeded Berry 2-celled, 2-seeded.—Upright deciduous shrubs, with simple leaves, and twin inodorous flowers.

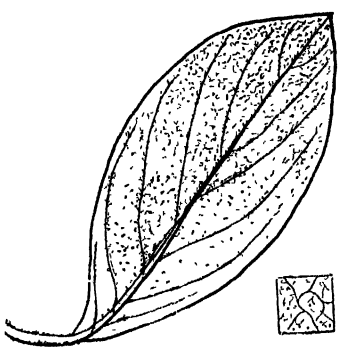


Fig. CLI. 1

1. L. *Xylosteum* (*The Fly Honeysuckle*). Stalks 2-flowered. Berries distinct. Leaves entire, downy, oval.——*Shrubberies.* Flowers pale yellow. The leaves, when viewed against the light, have minute transparent dots, as shown in Fig. 1.

CAPRIFOLIUM.

Calyx 5-toothed, persistent. Corolla tubular, 2-lipped, usually saccate at the base. Stamens 5. Ovary 3-celled, with the cells equally many-seeded. Berry 1-celled, 1-seeded.—Twining shrubs, with simple leaves, and capitate fragrant flowers.

1. C. *perfoliatum* (*The Honeysuckle*). Flowers ringent, whorled, terminal. Leaves deciduous; the uppermost confluent and perfoliate ——— *Woods and Hedges.*

2. C. *Periclymenum.* Heads of flowers ovate, imbricated, terminal. Leaves all separate, deciduous Flowers ringent.——— *Gardens.*

ORDER XXXIV. GALIACEÆ—MADDERWORTS, OR STELLATES.

ESSENTIAL CHARACTER.—*Calyx* superior, obsolete, or 4- 5- or 6-lobed. *Corolla* monopetalous, rotate, or tubular, regular, inserted into the calyx; the number of its divisions equal to those of the calyx. *Stamens* equal in number to the lobes of the corolla, and alternate with them. *Ovary* simple, 2-celled; *ovules* solitary, erect; *styles*, 2. *Fruit* a double, indehiscent pericarp, with 2 cells and 2 seeds. *Seeds* erect, solitary.—*Herbaceous* plants, with whorled *leaves*, destitute of *stipules*; angular *stems*; *flowers* minute.

Fig. CXLIX.—Viburnum Lantana. Fig. CL.—Viburnum opulus.
Fig. CLI.—Lonicera Xylosteum

*** These are small rough herbaceous plants, with minute white, yellow, or red flowers. Their double fruit, angular stems and whorled leaves, distinguish them among regular-flowered monopetalous orders.

GALIUM.

Corolla rotate, or campanulate, 5-cleft. Fruit dry, not crowned by the calyx.

1. G. *Aparine* (*Goose-grass, Whiptongue, Cleavers*). Leaves 8 in a whorl, lanceolate, keeled, rough, fringed with reflexed prickles. Stem weak. Fruit bristly. ——— *Hedges.* The ripe fruit is said to be the best substitute for coffee. Flowers white.

2. G. *uliginosum*. Leaves 6 in a whorl, obovate-lanceolate, rigid, bristle-pointed; their edges rough like the stem, with recurved prickles. Fruit smooth, smaller than the corolla. ——— *Commons, heaths, and ditches.* Flowers white.

3. G. *verum*. Leaves 8 in a whorl, linear, channelled, entire, rough. Flowers in dense panicles. Fruit smooth.

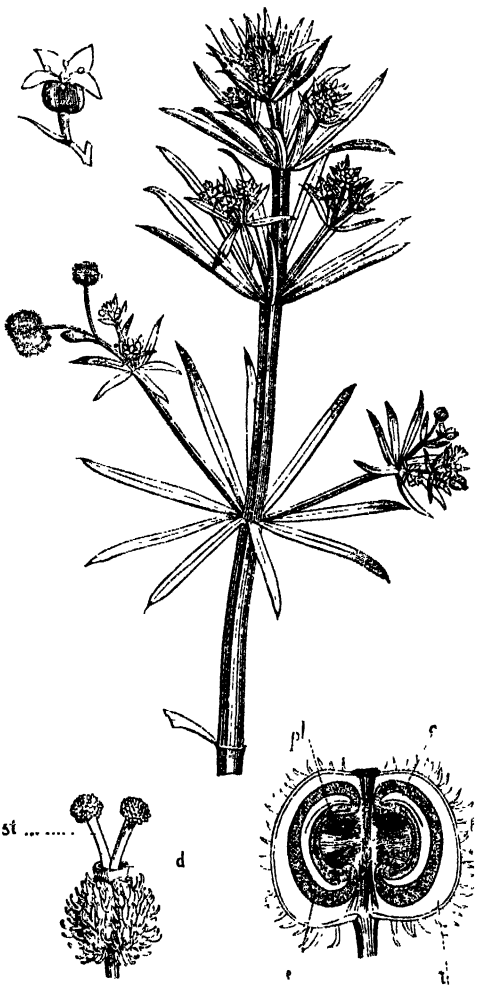


Fig CLII.

merly used for curdling milk, and is still called in Norfolk "Cheese Rennet." Its roots are said to yield a better red than Madder

4. G. *palustre* (*Water Bedstraw*). Fruit smooth. Leaves 4-6 in a whorl oblong-lanceolate, blunt, tapering to the base, and rough, as well as the loose spreading branched stem. —— *Sides of ditches and rivulets.* The plant turns black in drying, and the upper leaves are generally of unequal size. Flowers white.

5 G. *cruciatum* (*Crosswort*). Fruit smooth. Leaves 4 in a whorl, ovate, hairy, crossing each other at right angles. Flowers in lateral clustered heads, polygamous. — *Very common in hedges and thickets.* Flowers yellow.

6. G. *Mollugo* (*Greater Bedstraw*). Fruit smooth. Leaves 8 in a whorl, elliptical, mucronate, rough at the edge. Flowers white, in loose spreading panicles. Segments of the corolla with a distinct point.

*** These plants are all called "Bedstraws," because their harsh dry haulm was formerly employed in forming beds for the peasantry.

Fig CLII.—Galium Aparine, Goosegrass, or Cleavers, (Gratteron, Fr.) 1. A flower without the calyx and corolla; *d.* the disk, *st* the style. 2. A vertical section of a ripe fruit, very much magnified, *a.* albumen, *t.* testa or seedskin; *c* cotyledons; *pl.* placenta.

RUBIA.

Corolla campanulate, spreading, 4- or 5-lobed. Stamens 4 or 5. Fruit succulent.

1. R. *tinctorum* (*Madder*). Leaves in fours or sixes, somewhat stalked, lanceolate, reticulated, furnished at the margin with prickles hooked backwards.——*Gardens.* This plant is much cultivated in Belgium and Holland, for the sake of its roots, which are in great use among dyers, who obtain from them a rich brownish red colour.

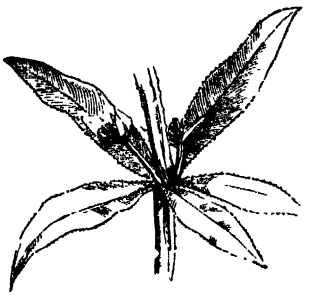


Fig. CLII. *b*.

ASPERULA.

Corolla funnel-shaped, with 3 or 4 segments. Fruit dry, not crowned by the calyx.

1. A. *Cynanchica.* Leaves linear, 4 in a whorl; the upper ones very unequal. Flowers all 4-cleft. Fruit smooth.——*Woods and open heaths.*

2. A. *odorata* (*Woodruff*). Leaves about 8 in a whorl, lanceolate. Flowers panicled, on long stalks.——*In woods and shady places.* Flowers white. When dried a little the plant acquires a most delicate fragrance, resembling that of Anthoxanthum odoratum (the Sweet Vernal Grass).

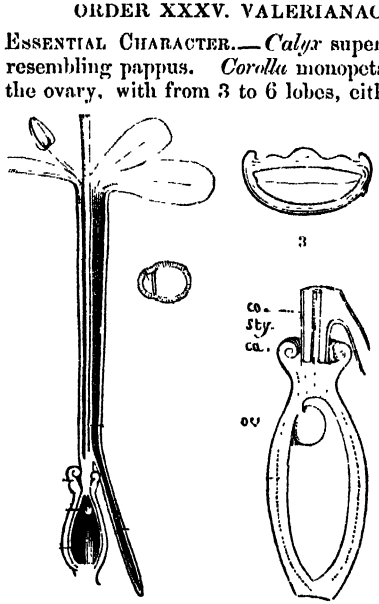
SHERARDIA

Corolla funnel-shaped. Stamens 4. Fruit crowned with a very distinct calyx, consisting of 4 segments, the two opposite ones of which are split at the point.

1. S. *arvensis* (*Field Madder*). Leaves 6 in a whorl; flowers in light blue heads, surrounded by the uppermost whorl.——*Corn-fields, &c.*

ORDER XXXV. VALERIANACEÆ—VALERIANWORTS.

Essential Character.—*Calyx* superior; the *limb* either membranous, or resembling pappus. *Corolla* monopetalous, tubular, inserted into the top of the ovary, with from 3 to 6 lobes, either regular or irregular, sometimes calcarate at the base. *Stamens* from 1 to 5, inserted into the tube of the corolla, and alternate with its lobes. *Ovary* inferior, with 1 cell, and sometimes 2 other abortive ones; *ovule* solitary, pendulous; *style* simple; *stigmas* from 1 to 3. *Fruit* dry, indehiscent, with 1 fertile cell, and 2 empty ones. *Seed* solitary, pendulous.—*Herbs.* *Leaves* opposite, without stipules. *Flowers* corymbose, panicled, or in heads.



1 Fig. CLIII. 2

*** Among the three following orders this is known by the flowers having no involucre, and the stamens being distinct. In Dipsaceæ there is an involucre to each flower, and in Compositæ the anthers grow together into a tube.

Fig. CLII *b*.—Rubia tinctorum.
Fig. CLIII.—Centranthus ruber. 1. A flower cut vertically; 2. a vertical section of the ovary; *co.* corolla, *sty.* style, *ca.* calyx, *ov.* ovule; 3. transverse section of the fruit.

VALERIANA.

Corolla regular, 5-lobed, without a spur. Stamens 3, otherwise as Centranthus.

1. V. *officinalis* (*Valerian*). Leaves all pinnate; leaflets lanceolate, nearly uniform.—— *Meadows.*

2. V. *dioica*. Flowers dioecious. Stem-leaves pinnatifid; radical ones ovate. —*Meadows.*

CENTRANTHUS.

Corolla 5-lobed, regular, with a spur. Stamen 1. Fruit 1-celled, crowned with the involute limb of the calyx, which changes into a feathery pappus.

1. C. *ruber* (*Red Valerian*). Leaves ovate-lanceolate, the upper somewhat toothed. Spur much shorter than the tube, and twice as long as the ovary. —— *Chalky cliffs and gardens.*

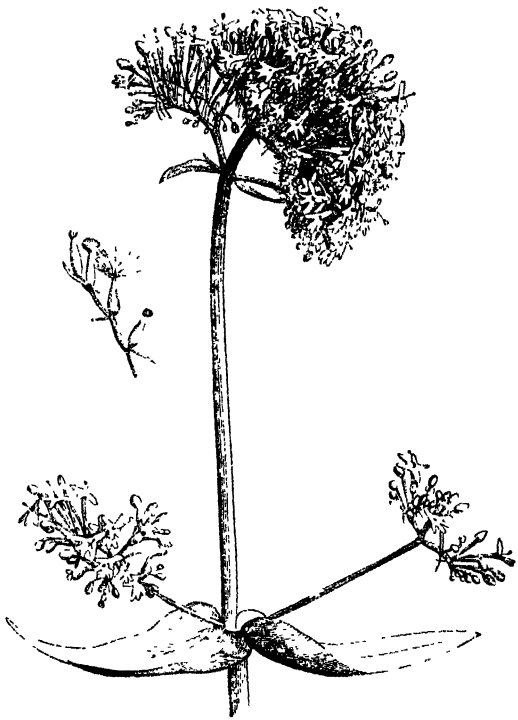


Fig. CLIV.

VALERIANELLA.

Corolla regular, 5-lobed, without a spur. Stamens 3. Fruit membranous, with 3 cells, crowned with the erect, not involute, limb of the calyx.

1. V. *olitoria* (*Lamb's Lettuce*). Stem weak.—Leaves lanceolate, entire. Fruit naked, roundish, compressed, rather flat on each side.—— *Gardens.* Sometimes used as salad.

ORDER XXXVI. DIPSACACEÆ—TEAZELWORTS

Essential Character.—*Calyx* superior, membranous, resembling pappus; surrounded by a scarious involucel. *Corolla* monopetalous, tubular, inserted in the calyx; *limb* oblique, 4- or 5-lobed, with an imbricated æstivation. *Stamens* 4, alternate with the lobes of the corolla; *anthers* distinct. *Ovary* inferior, 1-celled, with a single pendulous ovule; *style* 1; *stigma* simple. *Fruit* dry, indehiscent, 1-celled, crowned by the pappus-like calyx.—*Herbaceous* plants or *under-shrubs*. *Leaves* opposite or whorled. *Flowers* collected upon a common receptacle, and surrounded by a many-leaved *involucre*.

DIPSACUS.

Involucel with 4 sides, and 8 little excavations. Calyx with a somewhat cup-shaped limb. Stigma longitudinal. Leaflets of the involucre longer than the bract. Receptacle with spiny palæ.

1. D. *Fullonum* (*Teasel*). Leaves combined at the base, serrated. Scales of the

Fig. CLIV.—Centranthus ruber.

receptacle hooked backwards. Involucre reflexed. ——— *Hedges and fields.* The spiny flower-heads of this plant are extensively used in the process of fulling cloth. Flowers lilac.

SCABIOSA.

Involucel nearly cylindrical, with 8 little excavations. Calyx with a limb consisting of 5 setæ, occasionally partially abortive.

1. S. *succisa* (*Devil's Bit*). Corolla in 4 equal segments. Heads nearly globular. Stem-leaves distantly toothed. ——— *Pastures.*

2. S. *columbaria.* Corolla in 5 unequal segments. Radical leaves ovate, or lyrate, notched ; the rest pinnatifid, linear. — — *Pastures.*

Fig. CLV.

3. S. *atropurpurea.* Radical leaves obovate, often lyrate. Fruit heads ovate. Flowers dark purple, the florets of the ray rather longer than the involucre. — —

ORDER XXXVII. ASTERACEÆ.— COMPOSITES.

Essential Character. — *Calyx* superior, completely united with the *ovary*, and undistinguishable from it ; its *limb* either wanting, or membranous, divided into bristles, palæ, hairs, or feathers, and called *pappus*. *Corolla* monopetalous, superior, either ligulate, i. e. spread flat, or tubular. *Stamens* equal in number to the teeth of the corolla, and alternate with them ; the *anthers* cohering into a cylinder. *Ovary* inferior, 1-celled.

Fig CLV.—Scabiosa atropurpurea. 1. One of the florets of the ray ; 2 a floret of the disk, 3. the half-ripe flower cut perpendicularly to show the ovary with its calyx, and the double involucel.

with a single erect ovule; *style* simple; *stigmas* 2, either distinct or united. *Fruit* a small, indehiscent, dry pericarp, crowned with the limb of the calyx. *Seed* solitary, erect.—*Herbaceous* plants or *shrubs*. *Leaves* alternate or opposite, without stipules, usually simple. *Flowers* (called *florets*) unisexual or hermaphrodite, collected in dense *heads* upon a common *receptacle*, surrounded by an *involucre*. *Bracts* either present or absent; when present, stationed at the base of the florets, and called *paleæ of the receptacle*.

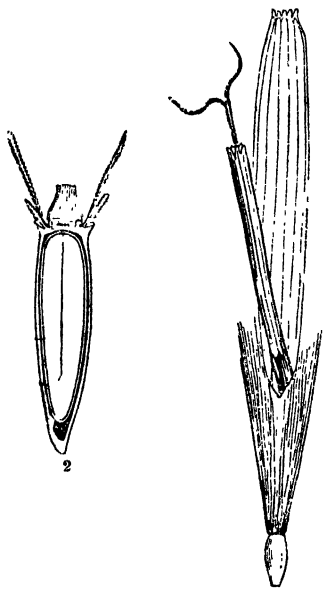


Fig. CLVI. 1 2

*** This is the largest of all the Natural Orders which systematic botanists have established, the genus Senecio alone consisting of nearly 600 species. In the European Flora there are three principal divisions, called *Corymbiferæ*, *Cynaraceæ*, and *Cichoraceæ*; of which the first two have most of their flowers tubular, the latter all of them ligulate; the two first being distinguished from each other by the involucres of one being soft and unarmed, of the other hard or spiny. Their differences stand thus:—

§ 1. *Corymbiferæ*. Most of the florets tubular. Involucre soft and unarmed. Style not tumid.

§ 2. *Cynaraceæ* Most of the florets tubular. Involucre hard or spiny. Style tumid near the end.

§ 3. *Cichoraceæ*. All the florets ligulate.

§ 1. CORYMBIFERÆ. *Most of the florets tubular. Involucre soft and unarmed. Style not tumid.*

EUPATORIUM.

Involucre cylindrical; scales imbricated, oval-oblong. Florets few, all tubular, hermaphrodite. Receptacle naked. Pappus pilose.

1. E. *cannabinum*. Leaves in 3 or 5 deep, lanceolate segments; the middle one longest.———*Ditches*.

PETASITES.

Involucre simple, herbaceous, with a few scales at the base. Flower-heads dicœcious. Female florets filiform, truncate: the female heads numerous in many rows, the hermaphrodite heads few and forming a single row in the ray. Sterile florets tubular, 5-toothed: of the female heads a few in the centre, of the male heads occupying the entire disk. Receptacle naked. Pappus hairy. Flower-heads racemose or thyrsoid white.

1. P. *vulgaris* (*Butterbur*). Leaves roundish-cordate, unequally toothed, downy beneath, the lobes of the base nearly or quite touching.———*Wet meadows and roadsides*. Scapes appearing before the leaves. The thyrse (contracted panicle) of the hermaphrodite plant ovate: of the female oblong with much smaller flower-heads. A troublesome creeping-rooted weed very difficult to extirpate. The flowers appear from March to May, and are very grateful to bees.

TUSSILAGO.

Involucre simple, membranous at the edge of its leaves; with a few scales occasionally at the base. Flower-heads monœcious. Female florets in the ray, in many rows, ligulate, entire. Hermaphrodite florets in the disk, tubular, 5-toothed. Receptacle naked. Pappus hairy.—Flower-heads solitary, yellow.

Fig. CLVI.—1. A ligulate floret with its pappus 2 fruit, with its ripe seed cut through, to show the embryo.

1. T. *Farfara* (*Coltsfoot*). Stalks clothed with scaly bracts. Leaves heart-shaped, angular, and toothed.———*Gravel-pits and waste sandy places.*

Fig. CLVI. *b*.

BELLIS.

Involucre hemispherical, many-leaved, simple; scales lanceolate. Flowers radiant. Receptacle naked, conical. Pappus 0.

1. B. *perennis* (*Day's Eye, or Daisy*). Root creeping. Scapes radical, naked.——— *Meadows and pastures.*

BIDENS.

Involucre with bractlets at the base; outer scales longer than the rest, and spreading. Flowers mostly floscular; florets all hermaphrodite, or, if ligulate in the ray, then female, or hermaphrodite. Receptacle flat, paleaceous. Pappus of from 2 to 5 persistent awns.

1. B. *tripartita*. Leaves in 3 segments. Bracts unequal. Bristles of the pappus or 3, erect.———*Ditches.*

Fig CLVI. *b*.—Tussilago Farfara.

ARTEMISIA.

Involucre ovate or round, imbricated. Florets all tubular; of the disk hermaphrodite, 5-toothed; of the ray slender, less numerous, entire, female. Receptacle naked or hairy. Pappus 0.

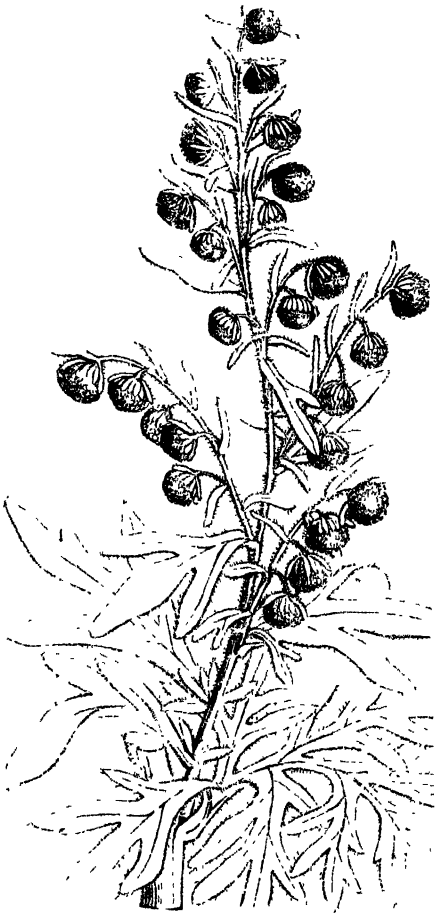


Fig CLVI. c.

1. A. *Absinthium* (*Wormwood*). Leaves in many deep segments, clothed with close silky down. Heads drooping, hemispherical. Receptacle hairy.———*Gardens.* Employed in medicine for its bitterness.

2. A. *Abrotanum* (*Southernwood*). Stem shrubby, erect, panicled. Leaves downy underneath, all stalked and without auricles at the base; segments extremely narrow. Heads hoary, roundish, drooping.———*Gardens.*

3. A. *vulgaris* (*Mugwort*). Leaves pinnatifid, flat, cut; downy beneath. Clusters simple. Heads ovate. Receptacle naked.———*Roadsides.*

4. A. *Dracunculus* (*Tarragon*). Stem herbaceous, erect. Leaves green, smooth, lanceolate-linear, undivided, the radical ones trifid at the point. Heads panicled, roundish, nodding. Scales of the involucre broad-elliptical: the inner scarious at the edge.———*Gardens.* Often used as a pickle, on account of its aromatic flavour.

Fig CLVI. c.—Artemisia Absinthium

HELIANTHUS.

Involucre imbricated. Florets of the ray ligulate, neuter; of the disk tubular, hermaphrodite. Anthers not caudate. Achænia all of the same form. Pappus of two or many paleæ, deciduous. Receptacle plano-convex, paleaceous.

1. H. *annuus* (*Sunflower*). Leaves all cordate, 3-ribbed, serrated Peduncles thick. Flowers nodding.———*Gardens.*

PULICARIA.

Involucre imbricated. Flowers radiant, with the ray yellow. Receptacle naked. Pappus hairy, simple.

1. P. *vulgaris.* Leaves clasping the stem, wavy. Stem much branched, hairy. Heads hemispherical; radius scarcely longer than the disk.———*Ditches.*

2. P. *dysenterica.* Leaves oblong, downy, clasping the stem with their heart shaped base. Stem woolly, panicled. Scales of involucre bristle-shaped, hairy.———*Ditches.*

FILAGO.

Involucre imbricated; scales equal, acuminate, scarious, discoloured, longer than the few-flowered head. Florets filiform, tubular, female in the circumference, hermaphrodite in the disk. Receptacle conical, toothed, tuberculated, or paleaceous.

1. F. *germanica.* Stem erect, proliferous, leaves lanceolate. Heads globose, many-flowered, lateral as well as terminal. Scales of involucre bristle-pointed.———*Heaths and waste places.*

ANTENNARIA.

Involucre imbricated, hemispherical, scales scarious, coloured. Flowers diœcious. Florets all tubular.—♂. Anthers with 2 bristles at the base. Stigmas truncate. Pappus filiform or clavate.—♀. Florets filiform, with a minute limb. Pappus capillary.

1. A. *margaritacea.* Leaves linear-lanceolate, acute, loosely cottony on the upper side; densely underneath. Stem branched in the upper part. Panicles corymbose, level-topped.———*Gardens.*

ANTHEMIS.

Involucre hemispherical; scales nearly equal, scarious at the margin, imbricated. Flowers radiant; of the disk hermaphrodite; of the ray lanceolate, female. Receptacle conical, paleaceous. Pappus a membrane or 0.

Fig. CLVII

Fig. CLVII.—Anthemis nobilis.

1. A. *nobilis* (*Chamomile*). Leaves doubly pinnate, semicylindrical, acute, a little downy. Stem procumbent. Paleæ membranous, obtuse, shorter than the florets. Pappus 0.——*Commons.* The true Chamomile, largely employed in medicine on account of its bitterness.

MATRICARIA.

Involucre hemispherical, imbricated; scales obtuse. Flowers radiant. Receptacle naked, conical. Pappus 0.

1. M. *Chamomilla.* Leaves smooth, pinnate; leaflets linear, simple, or divided. Rays spreading. Scales of involucre dilated, bluntish.———*Waste places.*

Fig. CLVIII.

CHRYSANTHEMUM.

Involucre hemispherical, imbricated; scales scarious at the margin. Flowers radiant. Receptacle naked. Pappus none, or a short membrane.

1. C. *Leucanthemum* (*Ox-eye Daisy*). Leaves clasping the stem, oblong, obtuse, cut; pinnatifid at the base, radical ones obovate, stalked.——— *Fields.*

SENECIO.

Involucre with bractlets at the base; the scales scorched at the apex. Flowers either flosculous or radiant. Receptacle naked. Pappus soft, hairy.

1. S. *vulgaris* (*Groundsel*). Heads dispersed, without rays. Leaves pinnatifid, toothed, obtuse, smoothish; clasping at the base. ———*Everywhere.*

2. S. *Jacobæa* (*Ragwort*) Rays spreading, oblong, toothed. Leaves doubly pinnatifid, somewhat lyrate, with spreading, toothed, smooth segments. Stem erect. Fruit of the disk silky.———*Hedgerows and roadsides.*

3. S. *aquaticus.* Ray spreading. Leaves lyrate, serrated, smooth, the lowest obovate and entire. Flower-heads hemispherical. Fruit perfectly glabrous.——— *Sides of ditches and rivulets, and in marshes.* Flower-heads large, yellow.

TANACETUM.

Involucre hemispherical, imbricated. Florets all tubular; of the disk hermaphrodite, 5-lobed; of the ray female, 3-lobed. Receptacle naked. Pappus naked, entire.

1. T. *vulgare* (*Tansy*). Leaves doubly pinnatifid, deeply serrated, naked.——— *Waysides.* Fragrant. Formerly used in cooking as an aromatic.

Fig. CLVIII. *b.*

ACHILLEA.

Involucre ovate, imbricated. Flowers radiant; of the disk hermaphrodite, of the ray short, female, and few. Receptacle narrow, flat, paleaceous. Pappus 0.

1. A. *Millefolium* (*Yarrow*). Leaves doubly pinnatifid, hairy; segments linear, toothed, pointed. Stem furrowed.

Fig. CLVIII.—Chrysanthemum leucanthemum. 1. The ovary and style.
Fig. CLVIII. *b.*—Achillea Millefolium.

§ 2. CYNARACEÆ. *Most of the florets tubular. Involucre hard or spiny. Style tumid near the end.*

CIRSIUM.

Involucre imbricated. Flowers hermaphrodite, all tubular. Filaments distinct. Pappus plumose, united into a ring at the base, deciduous. Receptacle hairy.

1. C. *lanceolatum*. Leaves decurrent, pinnatifid, hispid with variously spreading spinous lobes. Involucre ovate, shaggy. Stem furrowed, hairy. ——— *Waste places.*

2. C. *arvense*. Leaves sessile, pinnatifid, spinous, nearly smooth. Stem panicled, solid. Involucre ovate; outer scales spinous. Root creeping, tuberous. ——— *Commons and waste places.*

CENTAUREA.

Involucre imbricated; scales leafy, scarious, or spiny in various ways. Florets of the disk hermaphrodite; of the ray neuter and larger than the others. Receptacle paleaceous; paleæ jagged. Fruit inserted obliquely at the base. Pappus hairy.

1. C. *Cyanus*. Scales of involucre serrated. Leaves linear-lanceolate, entire; lower ones toothed towards their base. ——— *Corn fields.*

2. C. *Scabiosa*. Scales of involucre ovate, fringed, somewhat downy. Leaves pinnatifid; segments lanceolate, roughish, partly toothed. ——— *Hedges and fields.*

3. C. *Jacea*. Scales of involucre membranous, torn; lower ones pinnatifid. Leaves linear-lanceolate; radical ones elliptic-lanceolate, toothed. Flowers radiant. ——— *Hedges and fields.*

Fig. CLIX.—Centaurea Cyanus. 1. Floret; 2. anthers, 3. ripe fruit.

Involucre imbricated; scales pungent. Receptacle excavated like honeycomb. Fruit compressed, 4-cornered, furrowed transversely. Pappus hairy, deciduous; its hairs connected in a ring at the base.

1. O. *Acanthium*. Scales of involucre awl-shaped, spreading in every direction. Leaves ovate-oblong, sinuated, woolly on both sides.——— *Waysides.*

ARCTIUM

Involucre globose, glochidate (covered with scales terminating in a sharp hard hook, and finally constituting a bur). Fruit 4-sided. Pappus short, hairy. Receptacle chaffy.

1. A. *Lappa* (*Burdock*). Leaves heart-shaped, stalked, roundish, dull green, covered beneath with long, crisp, entangled hairs.——— *Waysides.* Flowers purple. Occasionally used by fraudulent dealers to adulterate tobacco. There are two varieties one with large flower-heads, with very little wool upon them (*A majus*), and one with smaller heads, covered with cobweb-hairs (*A. minus*). The roots are large, fleshy, and used on the continent as purgatives and diuretics.

Fig. CLIX.

CYNARA.

Involucre hard, fleshy, with thick, emarginate, hard pointed bracts. Receptacle very fleshy, covered with stiff hair-like paleæ. Pappus harsh, feathery. Fruit obovate, compressed, 4-cornered, hard and smooth, with an oblique scar.

1. C. *Scolymus* (*The Artichoke*). A perennial. Leaves spiny, partly pinnatifid and partly undivided. Scales of the involucre ovate.———*Of unknown origin.* Flowers purple. Cultivated for the sake of its sweet fleshy receptacles, called "bottoms." The "choke" of the plant consists of the paleæ of the receptacle and the harsh pappus.

2. C. *Cardunculus* (*The Cardoon*). A biennial. Leaves spiny, all pinnatifid. Scales of the involucre with a long spiny point.———*Coasts and islands of the Mediterranean. Cultivated in gardens*, for the sake of its fleshy leaf-stalks, and stems, which are blanched like celery and eaten after being stewed. Its heads are uneatable.

§ 3. CICHORACEÆ. *All the florets ligulate.*

LAPSANA.

Involucre with external bracteolæ; scales linear-lanceolate. Receptacle naked. Fruit quickly deciduous, not enveloped in the scales of the involucre. Pappus 0.

1. L. *communis*. Involucre of the fruit angular. Stem branched, panicled, leafy. Leaves ovate, stalked, toothed. Peduncles cylindrical, even. —— *Waysides.*

TARAXACUM.

Involucre imbricated, with an external series. Flowers in many rows. Achænium

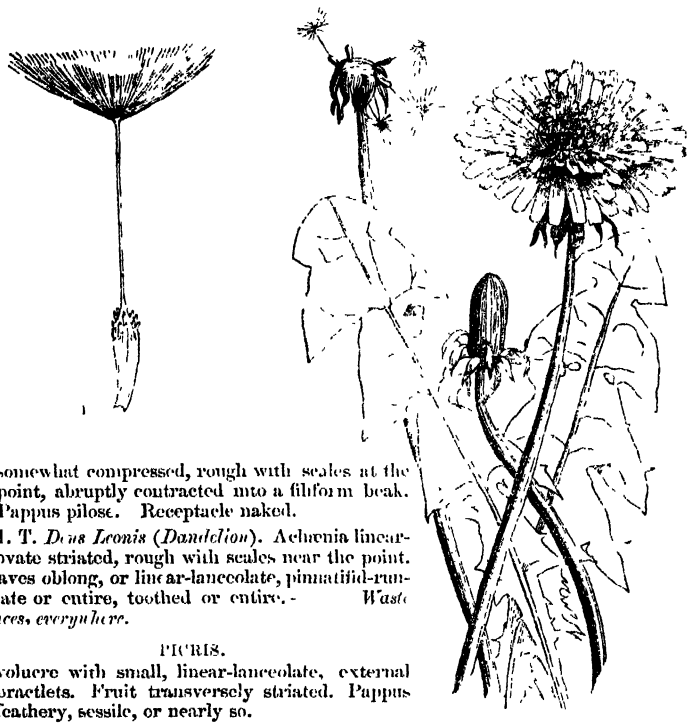


Fig. CLX.—Taraxacum Dens Leonis 1. The ripe achenium and pappus.

somewhat compressed, rough with scales at the point, abruptly contracted into a filiform beak. Pappus pilose. Receptacle naked.

1. T. *Dens Leonis* (*Dandelion*). Achænia linear-obovate striated, rough with scales near the point. Leaves oblong, or linear-lanceolate, pinnatifid-runcinate or entire, toothed or entire. — *Waste places, everywhere.*

PICRIS.

Involucre with small, linear-lanceolate, external bractlets. Fruit transversely striated. Pappus feathery, sessile, or nearly so.

1. P. *hieracioïdes*. Leaves lanceolate, many; radical ones toothed. Stem rough. —— *Woods.*

Involucre imbricated. Fruit all alike in form, prismatical, 4-cornered, a little contracted at the apex, with 4 furrows and the angles deeply crenate. Pappus hairy. Receptacle naked.

1. P. *vulgare*. Lower leaves sinuate-pinnatifid, toothletted: the upper amplexicaul, oblong and nearly entire. Peduncles thickened upwards. Leaves of the involucre close-pressed.——*Italy.* Sometimes cultivated in gardens as a salad, especially in France and Italy, in which latter country it is called *Terra crepola.* Annual. Flowers yellow.

CICHORIUM.

Involucre of 8 scales, united at the base and surrounded by 5 external bracteæ. Receptacle naked, or rather hairy. Pappus sessile, scaly, shorter than the fruit.

1. C. *Intybus* (*Succory*). Heads in pairs, each nearly sessile. Leaves runcinate.

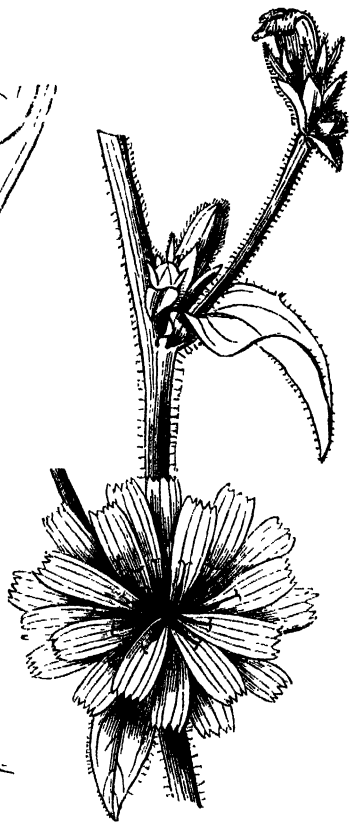


Fig. CLX. *b*.

Waysides. Flowers blue. This is the plant which is cultivated, under the name of Chicory, for its roots, which are largely employed as a substitute for coffee.

2. C. *Endivia* (*Endive*). Heads in pairs, or more, sessile or stalked. Floral leaves broad-ovate, at the base cordate-amplexicaul. Pappus 4 times as short as the achænia.———*Gardens.* A well-known salad.

Fig. CLX. *b*.—Cichorium Intybus.

SCORZONERA.

Involucre imbricated. Receptacle naked. Pappus feathery in several rows, the same in all florets. Fruit sessile, not beaked, with a lateral scar.

1. S. *hispanica* (*Viper's Grass. Scorzonera*). Root long, tap-shaped, succulent. Flower-heads solitary. Leaves stem-clasping, lanceolate, wavy. Involucre smooth. ——*Spain and South of Europe. Cultivated in gardens* for the sake of its sweet delicate eatable roots. Flowers yellow.

TRAGOPOGON.

Involucral leaves in a single row, 8—10, united at the base. Receptacle punctured. Pappus feathery, in several rows, the same in all florets. Fruit sessile, more or less muricated, with a lateral scar and a long uninterrupted beak.

1. T. *porrifolius* (*Salsafy*). Root long, tap-shaped, succulent. Leaves smooth, erect, linear-lanceolate, acuminate, entire. Peduncles clavate, fistular. —— *Meadows and moist grounds.* Cultivated for the same purposes as Scorzonera. Flowers purple.

CATANANCHE.

Involucre consisting of numerous scarious imbricated dry scales. Receptacles flat, hairy. Pappus consisting of 5—7 long palea. Fruit turbinate, without a beak, 5-cornered, furrowed, with close pressed hairs

1. C. *cærulea*. Leaves villous, linear, sometimes pinnatifid at the base. Scales of involucre mucronate.———*South of Europe.* A common garden annual, with solitary flower-heads on long naked peduncles. Flowers dull blue.

TOLPIS.

Involucre in a few rows, surrounded at the base with linear setaceous scales. Receptacle naked. Pappus in 1 row, consisting of stiff rough bristles, with a few minute scales interspersed, or sometimes forming a coronet. Fruit turbinate, striated, without a beak, all of the same form.

1. T. *barbata* (*Yellow Hawkweed*). Stem erect, branched, leafy. Leaves lanceolate, toothed. Scales of the involucre longer than itself.———*South of Europe.* A common garden annual. Flowers pale yellow.

BARKHAUSIA.

Flower-head many-flowered. Involucre with scales at its base, or even imbricated. Receptacle naked or hairy. Pappus white, hairy, in many rows. Fruit not winged, terete, the central ones furnished with a long tapering beak, those in the ray with either a very short beak or none at all.

1. B. *rubra* (*Purple Hawkweed*). Stems leafy and branched at the base, naked upwards. Most of the leaves radical, runcinate, lyrate, stalked those on the stem sessile, linear, incised at the base. Outer involucral scales lanceolate, acuminate, smooth; inner roughish, shorter than the fruit of the ray.———*South of Europe.* A common garden annual sold under the name of Crepis rubra.

APARGIA.

Involucre unequally imbricated with hairy black scales. Receptacle naked. Pappus feathery. Fruit with a beak.

1. A. *hispida* (*Rough Hawkbit*). Scape single-flowered, thickened upwards, slightly hispid, naked or with 1—2 small scales. Leaves runcinate, hispid with forked hairs. Pappus with an outer row of bristles.———*Heaths and pastures.* Flowers yellow; from July to September.

2. A. *autumnalis* (*Autumn Hawkbit*). Scape scaly upwards. Leaves lanceolate, toothed or pinnatifid nearly smooth. Peduncles clavate.— ——*Meadows and pastures.* Flowers yellow, in August. Pappus brownish white, without any outer row of bristles.

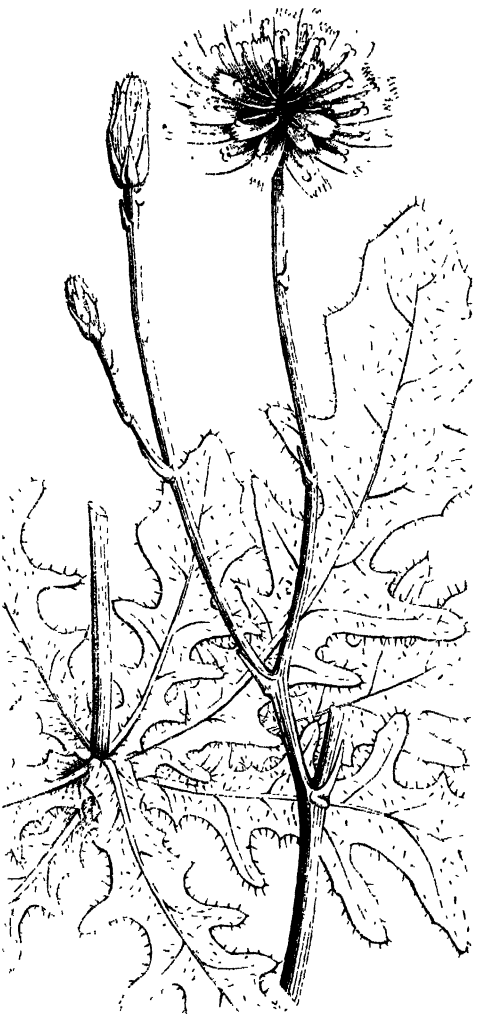


Fig CLX. *c.*

THRINCIA.

Involucre imbricated. Receptacle naked. Pappus of the ray with a short scaly cup,

Fig CLX. *c.*—Hypochæris radicata.

of the disk long and feathery. Fruits with a long taper beak, those of the ray enveloped in the scales of the involucre.

1. T. *hirta*. Leaves lanceolate, toothed, somewhat hispid with forked hairs. Scapes with solitary flower-heads, ascending, smooth near the ground.——*Gravelly pastures and moors.* In July and August. Flowers yellow.

Involucre oblong, imbricated. Receptacle paleaceous. Pappus feathery, stipitate, or sessile in the disk.

1. H. *radicata*. Leaves runcinate, bluntish, rough. Stems branched, naked, smooth. Peduncles scaly. Pappus of all the fruits stalked. ——*Pastures.*

LACTUCA.

Involucre oblong, imbricated; scales membranous at the margin. Receptacle naked. Pappus stipitate, hairy, soft, fugacious.

1. L. *sativa* (*Lettuce*). Leaves rough at the keel, amplexicaul, toothed, entire. Flowers panicled. Beak of the achænium white, as long or longer ——*Gardens.*

SONCHUS.

Involucre oblong, imbricated, ovate at the base. Receptacle naked. Fruit striated longitudinally. Pappus short, sessile, hairy.

1. S. *oleraceus* (*Sowthistle*). Peduncles cottony. Involucre smooth. Leaves runcinate, toothed; the keel prickly. ——*Everywhere.*

HIERACIUM.

Involucre imbricated. Receptacle naked, or with a few short hairs. Pappus hairy, sessile, generally dirty brown.

1. H. *Pilosella*. Leaves elliptical, entire; cottony beneath. Runners creeping. Stalks single-headed, naked. ——*Woods and banks.*

2. H. *aurantiacum*. Leaves elliptical, acute, entire. Stalk almost leafless, hairy, densely corymbose, many-headed. Involucre shaggy ——*Gardens.*

3. H. *umbellatum*. Stem erect, leafy, almost solid, imperfectly umbellate. Leaves scattered, linear, slightly toothed, nearly smooth as well as the involucre. ——*Meadows and pastures.*

ORDER XXXVIII. CAMPANULACEÆ—BELLWORTS.

ESSENTIAL CHARACTER.—*Calyx* superior, usually 5-lobed, persistent. *Corolla* monopetalous, inserted into the top of the calyx, usually 5-lobed, withering on the fruit, regular. *Æstivation* valvate. *Stamens* inserted into the calyx alternately with the lobes of the corolla, to which they are equal in number; *filaments* broad and valvate at the base; *anthers* 2-celled, distinct. *Ovary* inferior, with 2 or more polyspermous cells; *style* simple, covered with collecting hairs; *stigma* naked. *Fruit* dry, crowned by the withered calyx and corolla, dehiscing. *Seeds* numerous, attached to a placenta in the axis.—*Herbaceous* plants or *under-shrubs*, yielding a white milk. *Leaves* almost always alternate, simple, or deeply divided, without stipules. *Flowers* in racemes, spikes, or panicles, or in heads, usually blue or white, very rarely yellow.

*** The only European order likely to be mistaken for this is Lobeliaceæ, which is distinguished by the syngenesious anthers.

PHYTEUMA.

Calyx 5-cleft. Corolla rotate, with a very short tube, and 5 long linear segments. Stamens 5. Stigma 3-parted. Capsule 3-celled, opening by lateral perforations. Flowers in spikes or heads.

1. P. *spicatum*. Radical leaves blunt, cordate-ovate, doubly toothed, with a winged

foot-stalk; cauline linear-lanceolate, toothed, sessile. Bracts few, linear-lanceolate, acuminate, 4 times as short as the long spike. ——— *Gardens.*

CAMPANULA.

Calyx 5-cleft, sometimes with the recesses reflexed. Corolla campanulate, 5-cleft. Stamens 5, with the filaments broadest at the base. Stigma 4- or 5-parted. Capsule 3- or 5-celled, opening by perforations towards the base.

1. C. *Rapunculus* (*Rampion*). Leaves wavy, crenate, roughish: radical ones elliptic-lanceolate. Stem angular; hairy below. Panicle compact. Calyx entire.——— *Gardens.* Formerly used as a substitute for Radishes, in the winter time.

2. C. *Rapunculoides.* Leaves roughish; radical ones heart-shaped, crenate, stalked; uppermost sessile, lanceolate. Flowers drooping, unilateral, in a terminal, bracteated, upright cluster. Calyx reflexed. ———*Gardens.*

3. C. *Trachelium.* Stem angular. Leaves lanceolate, partly heart-shaped, sharply serrated, bristly as well as the calyx Stalks axillary, with few flowers.———*Gardens.*

4. C. *rotundifolia* (*Harebell*). Radical leaves heart or kidney-shaped, serrated; stem-leaves linear, entire. —— *Heaths and hedgerows.*

5. C. *Medium* (*Canterbury Bells*) Stem undivided, erect, leafy. Leaves lanceolate or linear, crenated. Flowers erect. Segments of the calyx lanceolate-ovate, roughly ciliated.——— *Gardens.*

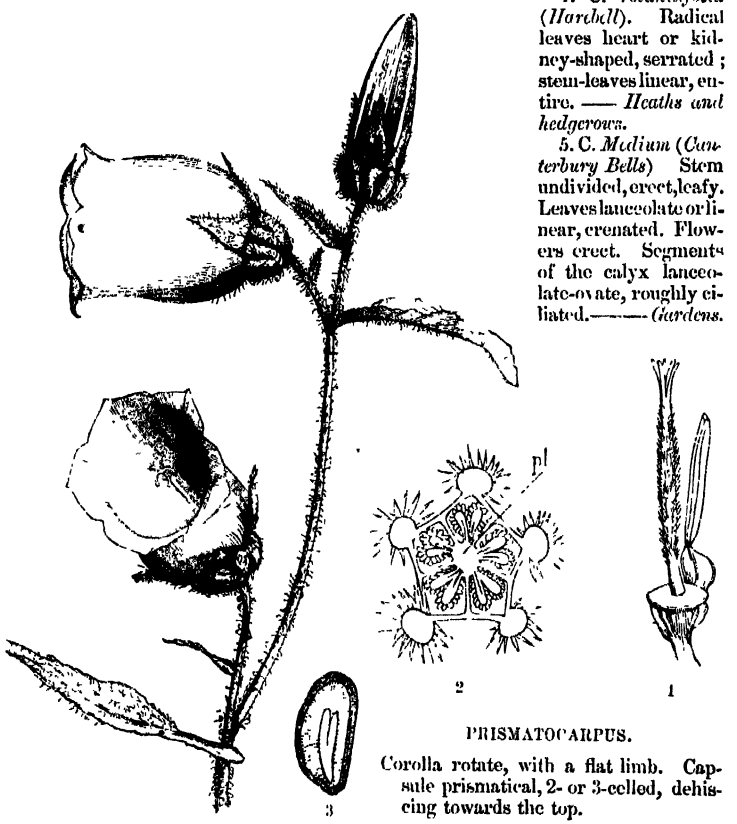


Fig CLXI.

PRISMATOCARPUS.

Corolla rotate, with a flat limb. Capsule prismatical, 2- or 3-celled, dehiscing towards the top.

1. P. *Speculum* (*Venus's Looking-glass*). Stem erect, branched, divaricating; lower branches long, ascending. Leaves oblong, lower obovate. Flowers solitary. Segments of the calyx linear, length of the ovary and corolla.———*Gardens.*

Fig CLXI.—Campanula Medium. 1. Ovary, style, stigma, and stamen; 2. transverse section of calyx and ovary; *pl.* placentæ, 3. perpendicular section of a seed

ORDER XXXIX. ERICACEÆ—HEATHWORTS.

ESSENTIAL CHARACTER.—*Calyx* 4- or 5-cleft, nearly equal, inferior. *Corolla* hypogynous, monopetalous, 4 or 5-cleft, regular or irregular. *Stamens* definite, equal in number to the segments of the corolla, or twice as many, hypogynous, or scarcely inserted into the base of the corolla; *anthers* 2-celled, the cells hard and dry, separate either at the apex or base, where they are furnished with some kind of appendage, and dehiscing by a pore. *Ovary* surrounded at the base by a disk, or secreting scales, many-celled, many-seeded; *style* 1, straight; *stigma* 1, undivided or toothed, or 3-cleft. *Fruit* capsular, many-celled, with central placentæ. *Seeds* indefinite, minute.—*Shrubs* or *under-shrubs*. *Leaves* evergreen, rigid, entire, whorled, or opposite, without stipules. *Inflorescence* variable, the pedicels generally bracteate.

*** The hypogynous stamens and anthers bursting by pores distinguish these among monopetalous orders. *Solanum*, which has similar anthers, but which does not belong to the order, has the stamens inserted upon the corolla.

ARBUTUS.

Calyx small, 5-parted. Corolla ovate, with a small 5-cleft revolute limb. Stamens 10, villous at base; anthers with 2 pores at the tip. Berry granular, 5-celled, many-seeded.

1. A. *Unedo* (*Strawberry Tree*). Stem arboreous. Leaves smooth, bluntly serrated. Panicle terminal. Berry with many seeds.———*Gardens*.

CALLUNA.

Calyx of 4 coloured sepals, surrounded by 4 coloured bracteæ. Corolla campanulate, 4-cleft. Stamens 8. Capsule 4-celled, the dissepiments adhering to the axis, and with 4 valves dehiscing through the dissepiments.

1. C. *vulgaris* (*Ling, or Heather*). Leaves very small, scale-like, closely imbricated. ———*Heaths*.

ERICA.

Calyx 4-parted. Corolla campanulate, often ventricose, 5-toothed. Stamens 8. Capsule with from 4 to 8 cells, and the same number of valves.

1. E. *Tetralix*. Anthers horned. Style nearly concealed. Corolla ovate. Leaves fringed, 4 in a whorl. Flowers in round tufts.———*Heaths*.
2. E. *cinerea*. Anthers crested. Style a little prominent. Stigma capitate. Corolla ovate. Leaves 3 in a whorl.———*Heaths*.

Sub-Order VACCINIEÆ.

ESSENTIAL CHARACTER.—*Calyx* superior. *Corolla* monopetalous, lobed as often as the calyx. *Stamens* double the number of the lobes of the corolla, inserted into an epigynous disk; *anthers* with 2 horns and 2 cells, bursting by pores. *Ovary* inferior, many-seeded; *stigma* simple. *Berry* 4- or 5-celled; cells 1- or many-seeded. *Seeds* minute.—*Shrubs*, with alternate coriaceous leaves.

*** This sub-order, or order, differs from Ericaceæ in little except having an inferior ovary.

OXYCOCCUS.

Corolla rotate, reflexed.

1. O. *palustris* (*Cranberry*). Stem filiform, creeping. Leaves evergreen, ovate, acute, ash-coloured beneath. Flowers on long stalks, nodding.———*Fens, among running water*. Its scarlet fruit are sold in large quantities for tarts and marmalade.

VACCINIUM.

Corolla globose, or campanulate.

1. V. *Myrtillus* (*Bilberry*). Leaves deciduous, ovate, finely serrated, smooth. Branches angular. Peduncles axillary, 1-flowered, nodding.———*Heaths and moors*. Flowers pale green, tinged with pink. Berries black.

ORDER XL. PRIMULACEÆ—PRIMWORTS.

ESSENTIAL CHARACTER. — *Calyx* divided, inferior, regular, persistent. *Corolla* monopetalous, hypogynous, regular; the *limb* 5-cleft, seldom 4-cleft. *Stamens* inserted upon the corolla, equal in number to its segments, and opposite them. *Ovary* 1-celled; *style* 1; *stigma* capitate.

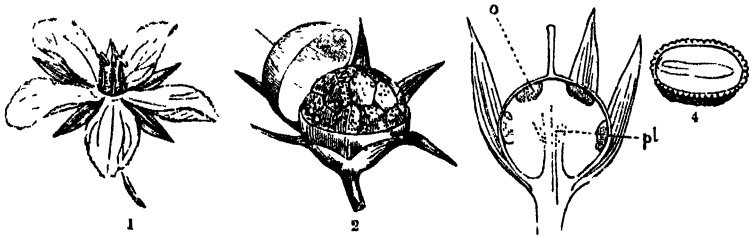


Fig. CLXII.

Capsule opening with valves; *placenta* central, distinct. *Seeds* numerous. —*Herbaceous* plants. *Leaves* usually opposite, either whorled or scattered.

*** No other monopetalous European plants with one style have the stamens opposite the lobes of the corolla, unless they are more numerous than the lobes.

Fig. CLXIII.

LYSIMACHIA.

Calyx 5-parted. Corolla rotate, 5-cleft. Stamens 5. Capsule globose, with 5 or 10 valves.

1. L. *vulgaris*. Clusters panicled, terminal. Leaves ovate-lanceolate, acute.——*Woods.*

2. L. *nemorum*. Leaves ovate, acute. Flowers solitary. Stem procumbent. Stamens smooth.——*Woods.*

3. L. *Nummularia* (*Moneywort*). Leaves somewhat heart-shaped. Flowers solitary. Stem prostrate, creeping. Stamens glandular.——*Woods.*

ANAGALLIS.

Calyx 5-parted. Corolla rotate, 5-lobed. Capsule globose, dehiscing by a transverse incision.

1. A. *arvensis* (*Pimpernel*). Leaves ovate, dotted beneath. Stem procumbent. Corolla minutely notched.——*Fields.* This is also called the Shepherd's Weather-glass, because it closes its scarlet blossoms on the approach of rain.

PRIMULA.

Calyx 5-toothed. Corolla hypocrateriform; the limb 5-lobed, usually emarginate; the orifice dilated; the tube taper, as long as the calyx or longer. Anthers usually tapering to the point. Capsule ovate, dehiscing at the apex, with 5 or 10 teeth. Seeds minute, very numerous.

Fig. CLXII.—Anagallis arvensis. 1. A flower; 2. a ripe fruit, with the lid falling off; 3. a section of the same, to show *pl.* the placenta; 4. a section of the seed.
Fig. CLXIII.—Anagallis arvensis.

1. P. *veris* (*Cowslip*). Leaves toothed, wrinkled, contracted towards the middle. Stalk many-flowered. Limb of the corolla concave.———*Meadows.*

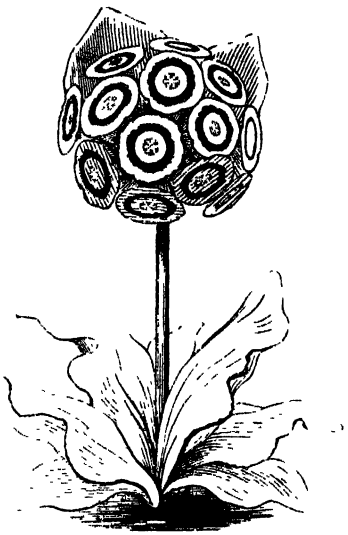


Fig. CLXIV.

2. P. *elatior* (*Oxlip*). Leaves toothed, wrinkled, contracted towards the middle. Stalk many-flowered. Limb of the corolla flat.———*Meadows.*

3. P. *acaulis* (*Primrose*). Leaves obovate-oblong, toothed, wrinkled. Stalks single-flowered. Limb of the Corolla flat.——*Banks and woods.*

4. P. *Auricula.* Leaves obovate, with scattered glands on the edge. The scape and umbel covered with meal. Involucre much shorter than the pedicels.——*Gardens.* A favourite among florists, who have a great many varieties in colour and form.

CYCLAMEN.

Calyx 5-parted. Corolla rotate, with a revolute limb. Capsule with 5 valves.

1. C. *europæum.* Leaves toothed at the edge, cordate, roundish or ovate. ——— *Gardens.* Commonly called Sow Bread, because it is the favourite food of the wild-boar.

This plant is remarkable for the singular manner in which the flower-stalks acquire a spiral direction as the *fruit is ripening*, in consequence of which it is eventually almost buried in the soil.

Fig. CLXV.

ORDER XLI. GENTIANACEÆ—GENTIANWORTS.

ESSENTIAL CHARACTER.—*Calyx* inferior, persistent. *Corolla* monopetalous, hypogynous, usually regular and persistent; the limb divided, equal, its lobes of the same number as those of the calyx, generally 5, with an imbricated twisted æstivation. *Stamens* inserted upon the corolla, all in the same line, equal in number to the segments, and alternate with them. *Ovary* single, 1- or 2-celled, many seeded; *style* 1, continuous; *stigmas* 1 or 2. *Capsule* or *berry* many-seeded, with 1- or 2-cells, generally 2-valved; the margins of the valves turned inwards. *Seeds* small.—*Herbaceous* plants, seldom *shrubs*, generally smooth. *Leaves* ribbed, without stipules; sessile, or having their petioles confluent in a little sheath. *Flowers* terminal or axillary.

*** No better marks than those of their ribbed leaves, or parietal placentæ, are required to recognise these plants among the other monopetalous orders of the European flora. In *Menyanthes trifoliata*, however, the leaves are 3-lobed, instead of being 3-ribbed, and in Villarsia they resemble those of a Water Lily.

Fig. CLXIV.—Primula Auricula. Fig. CLXV.—Cyclamen europæum.

GENTIANA.

Calyx 4- or 5-cleft. Corolla funnel-shaped, or hypocrateriform, 4- or 5-cleft, with the orifice naked. Stamens 5. Stigma 2-lobed. Seed not bordered.

1. G. *acaulis*. Flowers solitary, 5-cleft, bell-shaped, about as long as the quadrangular stem.———*Gardens.*

2. G. *Amarella*. Corolla salver-shaped, 5-cleft; bearded in the throat. Segments of the calyx nearly equal. Stem flowering from top to bottom, with short axillary branches.———*Bleak heaths.*

3. G. *campestris*. Corolla salver-shaped 4-cleft, bearded in the throat. Teeth of the calyx unequal; the two outer broadly elliptical.——*Hilly calcareous pastures.* Flowers dull violet.

N.B. Both this and No. 2 are dwarf annual plants with a rosette of leaves next the ground, and branching leafy stems. They are probably mere varieties of each other. In G. *Amarella* the stem-leaves are rather longer and more acute than in G. *campestris*.

4. G. *asclepiadea*. Flowers opposite, axillary and terminal, 5-cleft, not bearded in the throat; tube of the corolla clavate-campanulate. Leaves sessile, lanceolate, acuminate, with an ovate rounded base, 5-nerved, rough at the edge.——*Mountains of Europe. Common in gardens.* Flowers brilliant blue.

5. G. *lutea* (*Officinal Gentian*). Flowers in whorls, the lowest stalked. Corolla rotate, 5-parted, not bearded in the throat, with lanceolate narrow segments 3 times as long as the tube. Leaves elliptical, ribbed.——*Swiss and German Alps. Gardens.* A perennial with a long bitter tap-root. Stem 3—4 feet high. Flowers bright yellow. This is the plant from which the Gentian root of the shops is principally obtained.

ERYTHRÆA.

Calyx 5-cleft. Corolla funnel-shaped, withering, with a short limb. Stamens 5. Anthers, when burst, becoming spiral. Style erect. Stigmas 2, roundish. Capsule linear.

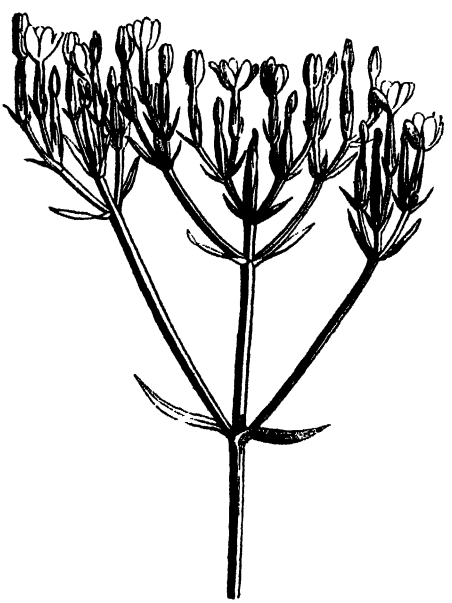


Fig. CLXV. *b*.

1. E. *Centaurium* (*Centaury*). Stem nearly simple. Panicle forked, corymbose. Leaves ovate-lanceolate. Calyx half the length of the tube; its segments partly

Fig. CLXV. b.—Erythræa Centaurium.

combined by a membrane.———*Pastures.* Flowers bright pink. Several varieties or supposed forms are known in this country. The whole plant is extremely bitter, and when dried is used in country places as a substitute for Gentian root.

MENYANTHES.

Calyx 5-parted. Corolla funnel-shaped; the limb spreading, 5-parted, bearded internally, with a simple margin. Stamens 5. Style 1. Stigma capitate, with from 2 to 5 furrows. Glands 5, hypogynous, alternate with the stamens. Capsule 1-celled, 2-valved; the valves bearing the seed in their axis.

M. *trifoliata* (*Buckbean*). Leaves ternate. Disk of the corolla densely shaggy. -*Bogs and ditches.* Flowers white, with a tinge of pink. The whole plant very bitter. Rhizome and seed used as a substitute for Gentian.

Fig. CLXV. *c.*

Fig. CLXV. *c.*—Menyanthes trifoliata. *a.* Seed-vessel; *b.* section of ditto; *c.* seed.

ORDER XLII. CONVOLVULACEÆ—BINDWEEDS.

ESSENTIAL CHARACTER.— *Calyx* persistent, in 5 divisions, remarkably imbricated, as if in more whorls than one, often very unequal. *Corolla* monopetalous, hypogynous, regular, deciduous; the limb 5-lobed, plaited. *Stamens* 5, inserted into the base of the corolla, and alternate with its segments. *Ovary* simple, with 2 or 4 cells, few-seeded, the ovules definite and erect; *style* 1, usually divided at the top; *stigmas* obtuse or acute. *Disk* annular, hypogynous. *Capsule* with the valves fitting, at their edges, to the angles of a loose dissepiment, bearing the seeds at its base.—*Herbaceous* plants or *shrubs*, usually twining and milky, smooth, or with a simple pubescence. *Leaves* alternate, undivided, or lobed, seldom pinnatifid, with no stipules. *Inflorescence* axillary or terminal; *peduncles* 1- or many-flowered, the partial ones generally with 2 bracts.

Fig. CLXV. *d*.

*** The remarkably imbricated calyx and twining habit render it impossible for such plants of this order as belong to the European Flora to be mistaken, if the most ordinary attention is paid to their examination. Care, however, must be taken to remember that there are many other orders containing twining plants.

CALYSTEGIA.

Calyx 5-parted, enclosed in 2 foliaceous bracts. Corolla campanulate, with 5 plaits. Stamens nearly equal, shorter than the limb. Ovary half 2-celled, 4-seeded. Style undivided. Stigmas 2, obtuse (taper or round). Capsule 1-celled.

1. C. *sepium* (*Bindweed*). Leaves arrow-shaped, abrupt at the posterior lobes. Stalks square, single-flowered.——*Hedges.*

CONVOLVULUS.

Calyx 5-parted, naked, or with 2 small bracteæ at the base. Corolla campanulate, with 5 plaits. Stamens shorter than the limb. Ovarium 2-celled, rarely 3-celled; cells 2-seeded. Style undivided. Stigmas 2, filiform. Capsule valvular.

1. C. *arvensis*. Leaves arrow-shaped, acute at each end. Stalks mostly single-flowered.——*Hedges.*

Fig CLXV. *d*.—Calystegia sepium.

2. C. *Tricolor*. Stem herbaceous, round, villous. Leaves lanceolate-obovate, somewhat spathulate, ciliated at the base. Peduncles 1-flowered, usually longer than the leaf. Calyx ovate-lanceolate, acute. Corolla 3-coloured.———*Gardens*. From Sicily.

Fig. CLXVI.

ORDER XLIII. BORAGINACEÆ—BORAGEWORTS.

ESSENTIAL CHARACTER.—*Calyx* persistent. *Corolla* hypogynous, monopetalous, generally regular, 5-cleft, sometimes 4-cleft. *Stamens* inserted upon the petals, equal to the number of lobes of the corolla, and alternate with them. *Ovary* 4-parted, 4-seeded; *style* simple, arising from the base of the lobes of the ovary; *stigma* simple or bifid. *Nuts* 4, distinct.—*Herbaceous* plants or *shrubs*. *Stems* round. *Leaves* alternate, covered with asperities, consisting of hairs proceeding from an indurated enlarged base. *Flowers* in 1-sided gyrate spikes or racemes, or panicles, sometimes solitary and axillary.

*** The four-lobed ovary in this order is so like that of Labiatæ that the student will not distinguish it. He is therefore to remember that in Boraginaceæ there is a 4-lobed ovary, symmetrical flowers, and alternate leaves; and in Labiatæ a 4-lobed ovary, unsymmetrical flowers, and opposite leaves.

SYMPHYTUM.

Calyx 5-cleft. Corolla cylindrical, campanulate; tube very short; limb ventricose, with 5 short lobes. Scales of the orifice subulate, converging.

1. S. *officinale* (*Comfrey*). Leaves ovate-lanceolate, decurrent, finely hairy. Stem branched. Anthers twice as long as their filament.———*Meadows and gardens*.

ECHIUM.

Calyx 5-parted. Corolla with a short tube; limb large, campanulate, obliquely 5-lobed; segments unequal; the 2 upper largest, the lowest small, acute, and reflexed. Nuts covered with little tubercles.

1. E. *vulgare*. Stem bristly and warty. Stem-leaves lanceolate, bristly, single-ribbed. Spikes lateral, deflexed, hairy.———*Waysides*.

Fig. CLXVI.—Convolvulus arvensis.

MYOSOTIS.

Calyx 5-cleft, or 5-toothed. Corolla hypocrateriform, with a short tube ; limb flat, with 5 emarginate lobes. Scales of the orifice convex, converging. Nuts smooth.

Fig. CLXVII.

1. M. *palustris* (*Forget-me-not*). Nuts smooth. Leaves and calyx roughish, with close bristles. Clusters leafless. Calyx funnel-shaped, with short broad spreading teeth. Limb of the corolla horizontal, longer than the tube. Root creeping.——*Ditches.*

BORAGO.

Calyx 5-parted. Corolla rotate, 5-cleft, usually spreading. Scales of the orifice obtuse, emarginate. Nuts wrinkled.

1. B. *officinalis* (*Borage*). Limb of the corolla flat, much longer than the tube ; mouth with a double row of valves, the innermost awl-shaped, bearing the stamens.——*Banks and gardens.* Flowers blue.

Fig.

ANCHUSA.

Calyx 5-cleft. Corolla funnel-shaped, 5-lobed ; the limb erect ; the lobes entire. The other characters of Lycopsis.

1. A. *italica.* Stem branched, erect. Leaves lanceolate, wavy, hispid, shining. Racemes double, with linear-lanceolate bracts. Calyx longer than the tube of the corolla. Scales of the corolla oblong, shaggy.——*Gardens.* Flowers dark blue.

LYCOPSIS.

Calyx 5-cleft. Corolla funnel-shaped, 5-lobed ; limb nearly erect ; tube incurved. Scales of the orifice ovate, prominent, converging. Stigma emarginate. Nuts sculptured at the base.

1. L. *arvensis.* Leaves lanceolate, wavy, somewhat toothed, very bristly. Stalks of the flowers and fruit erect. Limb of the corolla slightly unequal.——*Waste places.*

CYNOGLOSSUM.

Calyx 5-parted. Corolla short, funnel-shaped, 5-lobed. Scales of the orifice convex, converging. Stigma emarginate. Nuts depressed.

1. C. *officinale* (*Hound's Tongue*). Stamens shorter than the corolla. Stem-leave broadly lanceolate, downy, sessile. Flowers without bracts.——*Wayssides.*

Fig. CLXVII. 1. Corolla cut open ; 2. a pistil ; 3. ripe fruit, two of the nuts having fallen off ; 4. a perpendicular section of a nut.

Fig. CLXVIII.—Flower and ovary of Borago officinalis.

ORDER XLIV. LAMIACEÆ—LABIATES.

ESSENTIAL CHARACTER.—*Calyx* tubular, inferior. *Corolla* monopetalous, hypogynous, bilabiate. *Stamens* 4, didynamous, inserted upon the corolla, the 2 upper sometimes wanting. *Ovary* deeply 4-lobed, seated in a fleshy hypogynous disk, the lobes each containing 1 erect ovule; *style* 1, proceeding from the base of the lobes of the ovary; *stigma* bifid, usually acute. *Fruit* 1 to 4 small nuts, enclosed within the persistent calyx.—*Herbaceous* plants or *under-shrubs*. *Stem* 4-cornered, with opposite ramifications. *Leaves* opposite, divided or undivided, without stipules, replete with receptacles of aromatic oil. *Flowers* in opposite, nearly sessile, axillary cymes, resembling whorls; sometimes solitary, or as if capitate.

LYCOPUS.

Calyx tubular, 5-cleft, with a naked orifice. Corolla tubular, 4-lobed, nearly equal; the upper lip broader and emarginate. Stamens 2.

1. L. *europæus*. Leaves stalked, ovate oblong, coarsely cut, pinnatifid at the base. Teeth of the calyx acuminate. Rudiments of sterile stamens wanting.——*Ditches.*

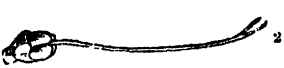
SALVIA.

Calyx somewhat campanulate, 2-lipped; the upper lip 3-toothed, the lower bifid; the orifice naked. Corolla ringent; the upper lip fornicate and emarginate. Stamens 2. Anthers with 2 cells, the one fertile, the other abortive, separated by a long linear connective.

Fig. CLXIX.

1. S. *Verbenaca*. Leaves serrated, sinuated, smoothish. Corolla much more contracted than the calyx. ——*Fields and waysides.*

2. S. *officinalis* (*Garden Sage*). Stem suffruticose; branches and younger leaves hoary. Leaves ovate-lanceolate and lanceolate, densely crenated, rugose. Bracts deciduous. Flowers purple. ——*Gardens.*



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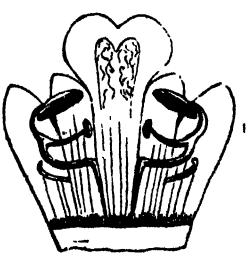

1

ROSMARINUS.

Corolla ringent, the upper lip 2-parted. Stamens 2, fertile, projecting, curved, furnished with a recurved tooth. Anthers 1-celled. Calyx 2-lipped.

Fig. CLXIX.—Salvia officinalis. 1. The corolla cut open; 2. ovary, style, and stigma.

1. *Rosmarinus officinalis* (*Common Rosemary*). An evergreen shrub. Leaves linear, obtuse, grey on the under side. Flowers pale blue.——*Gardens.* A native of wild places in the midland part of Europe.

Fig. CLXX.

2. N. *Glechoma* (*Ground Ivy*). Leaves crenated, reniform, the upper somewhat cordate. Teeth of the calyx ovate, awned, 3 times shorter than the tube. ——*Woods and dry ditches.* A popular country remedy for colds.

LAMIUM.

Calyx 5-toothed, awned, naked, spreading at the point. Corolla longer than the calyx; its orifice inflated;

THYMUS.

Calyx striated; the orifice closed with hairs; the limb 2-lipped; the upper lip 3-toothed; the lower bifid, or with 2 bristles. Corolla short; the upper lip emarginate; the lower 3-lobed; the middle lobe being broadest and emarginate, or entire. Nuts smooth.

1. T. *vulgaris* (*Thyme*). Whorls of flowers in heads or racemes. Leaves linear or oblong-ovate, acute, with glandular dots, revolute at the edge, fascicled in the axis. —— *Gardens.*

NEPETA.

Calyx cylindrical, with a naked orifice. Corolla with a long tube; the orifice gaping; the upper lip emarginate; the lower 3-lobed; the lateral lobes very short, reflexed; the intermediate one larger, crenate, and concave.

1. N. *Cataria.* Whorls stalked, crowded into spikes. Leaves finely downy, heart-shaped, stalked, with tooth-like serratures. —— *Hedges.* Flowers white.

Fig. CLXXI.

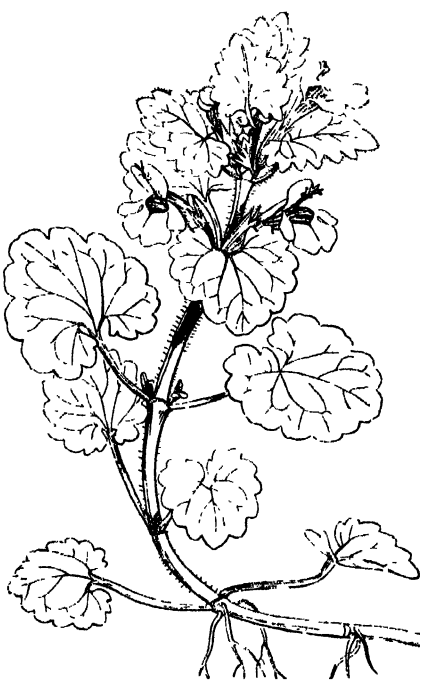

Fig. CLXXII.

Fig. CLXX.—Rosmarinus officinalis. Fig. CLXXI.—Lamium Album.
Fig. CLXXII.—Nepeta Glechoma.

the upper lip vaulted, entire ; the lower with 2 small lateral lobes, and a large emarginate one in the middle. Anthers smooth. Nuts 3-cornered, smooth.

1. L. *album* (*White Dead-Nettle*). Leaves heart-shaped, pointed, strongly serrated, hairy. Flowers about 20 in a whorl. Tube of the calyx shorter than its teeth. Upper lip of the corolla notched ; lateral teeth solitary, lanceolate. ——— *Banks*, &c.

2. L. *vulgatum* (*Red Dead-Nettle*). Leaves heart-shaped, bluntish, unequally crenate, stalked ; the upper ones crowded. Stem leafless in the middle. Calyx teeth lanceolate. Tube of the corolla closed, near the bottom, with hairs. ——— *Waste places.*

LAVANDULA.

Calyx unequally toothed, when in fruit closed. Upper lip of corolla bifid, lower trifid. Stamens enclosed. Anthers 1-celled, reniform, opening into the form of an orbicular cup.

1. L. *vera* (*Lavender*). Leaves oblong-linear or lanceolate entire ; the younger hoary and revolute at the edge. Spikes interrupted. Bracts rhomboid, ovate acuminate. ——— *Gardens.* Very sweet scented.

MENTHA.

Corolla little longer than the calyx, 4-lobed ; nearly equal; the upper lobe broadest and often emarginate. Stamens distant.

1. M. *viridis* (*Spearmint*). Spikes interrupted. Leaves sessile lanceolate, acute, naked. Bracteas bristle shaped, somewhat hairy as well as the teeth of the calyx. Flower-stalks very smooth.——— *Gardens.* This is the mint that is employed in sauce.

2. M. *rotundifolia.* Spikes interrupted, somewhat hairy. Leaves elliptical, obtuse, wrinkled, sharply crenate ; shaggy beneath. Bracteas lanceolate. ——— *Ditches.*

3. M. *piperita* (*Peppermint*). Spikes blunt, interrupted below. Leaves stalked, somewhat ovate, smoothish. Calyx very smooth at the base. ——— *Ditches.*

4. M. *Pulegium* (*Penny Royal*). Flowers whorled. Leaves ovate. Stem prostrate. Flower-stalks and calyx all over downy ; teeth of the latter fringed. ——— *Wet places.*

MARRUBIUM.

Calyx deeply furrowed, with the teeth hard and finally hooked. Upper lip of corolla flat, lower 3-lobed. Stamens short, hairy at base. Nuts truncate.

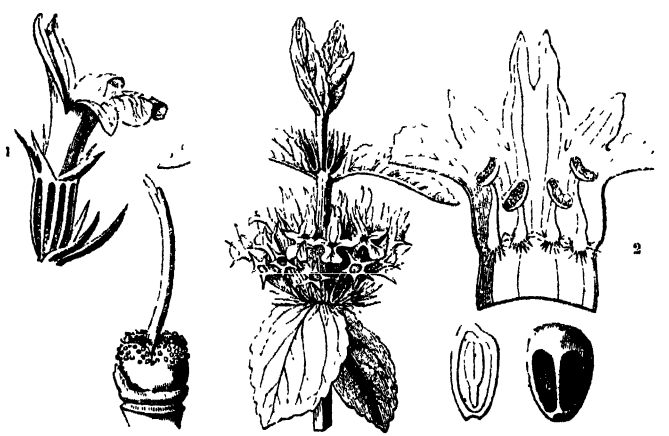

Fig. CLXXIII.

1. M. *vulgare* (*True Horehound*). Stem white with down. Leaves ovate, crenate, rugged, the lower cordate. Teeth of the calyx and bracts shaggy. ——— *Fields.* A decoction of this is regarded as a sovereign remedy for hoarseness ; and bittersweet lozenges prepared from it are commonly sold in the shops.

Fig. CLXXIII. Marrubium vulgare. 1. An entire flower seen in profile ; 2. a corolla slit open ; 3. the pistil ; 4 a nut ; 5. a vertical section of the latter, showing the embryo.

STACHYS.

Calyx angular, 5-cleft, or 5-toothed, acuminate. Corolla with a short tube; the upper lip vaulted; the lower 3-lobed, with the sides reflexed. Stamens, after the anthers are burst, bent back on each side. Nuts obsoletely 3-cornered, ovate, or roundish.

1. S. *sylvatica*. Six flowers in a whorl. Leaves heart-shaped, stalked. Stem solid. ——— *Woods*, &c. Flowers brownish purple, spotted.

BALLOTA.

Calyx campanulate, 5-cornered, with 10 streaks and 5 teeth. Corolla 2-lipped; the upper lip concave, crenate; the lower 3-lobed; the middle lobe larger and emarginate.

1. B. *nigra* (*Black Horehound*). Leaves ovate, undivided, serrated. Calyx funnel-shaped, abrupt, with short spreading teeth. ——— *Dry banks*. Flowers purple. Leaves with a heavy oppressive smell.

SCUTELLARIA.

Calyx short, with both lips entire; a concave scale lying upon the upper lip. Corolla longer, curved at the base; the upper lip compressed, vaulted, with 2 teeth at the base; the lower broad and emarginate. Nuts covered by the closed calyx.

1. S. *galericulata* (*Skull-cap*). Leaves lanceolate, crenate, rugged, heart-shaped at the base. Flowers axillary. ——— *Wet ditches*. Flowers blue.

PRUNELLA.

Calyx 2-labiate, with a naked orifice; the upper lip flat, somewhat truncate, 3-fid; the lower shorter, bifid. Corolla with the upper lip concave, entire, or 2-lobed; the lower 3-lobed; the middle lobe being larger than the rest, and emarginate. Filaments forked, or 2-toothed at the end; 1 tooth bearing the anther, the other naked. Nuts ovate, shining.

1. P. *vulgaris* (*Self-heal*). All the leaves ovate-oblong, stalked. Teeth of the upper lip of the calyx scarcely discernible. ——— *Commons, woods, &c.*

AJUGA.

Calyx 5-cleft, nearly equal. Corolla tubular, labiate; the upper lip very small, and with 2 teeth; the lower 3-lobed, with a large intermediate obcordate lobe. Nuts reticulated.

1. A. *reptans* (*Bugle*). Almost smooth, with a solitary stem, and creeping runners. Lower lip of the corolla 4-cleft. ——— *Woods and shady banks.*

Fig. CLXXIV.

ORDER XLV. SOLANACEÆ—NIGHTSHADES.

ESSENTIAL CHARACTER.—*Calyx* 5-parted, persistent, inferior. *Corolla* monopetalous, hypogynous; the *limb* 5-cleft, regular, or somewhat unequal, in *æstivation* plaited or imbricated. *Stamens* inserted upon the corolla, as

Fig. CLXXIV.—Ajuga reptans.

many as the segments of the limb, with which they are alternate; *anthers* bursting longitudinally, rarely by pores at the apex. *Ovary* 2-celled, with 2 polyspermous placentæ; *style* continuous; *stigma* simple. *Pericarp* with 2, or 4, or many cells; either a capsule with a double dissepiment parallel

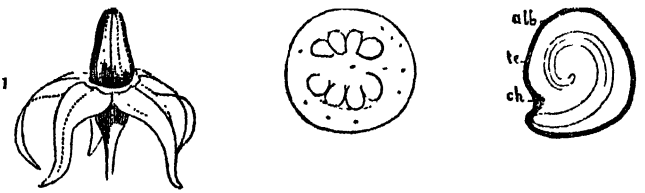

Fig. CLXXV.

with the valves, or a berry with the placentæ adhering to the dissepiment. *Seeds* numerous.—*Herbaceous* plants or *shrubs*. *Leaves* alternate, undivided, or lobed, sometimes collateral; the floral ones sometimes double, and placed near each other. *Inflorescence* variable, often out of the axil; the *pedicels* without bracts.

*** So far as the European Flora is concerned, this order is sufficiently characterised by its superior many-seeded ovary, axile placentæ and regular flowers, and by having the same number of stamens as there are lobes to the corolla, upon the side of which they grow. Solanaceæ differ from Ericaceæ in having epipetalous stamens; from Scrophulariaceæ in having regular symmetrical flowers; from Gentianaceæ in the leaves not being ribbed, and in the placentæ being central; from Primulaceæ in the stamens being alternate with the lobes of the corolla, and the placentæ axile. They are in almost all cases more or less poisonous; even those which are food, like the Potato, having their share of deleterious matter, although not in the parts that are eaten.

SOLANUM.

Calyx persistent, with from 5 to 10 divisions. Corolla monopetalous, rotate; the tube very short; the limb spreading, with 4, 5, or 6 divisions. Stamens 4, 5, or 6. Anthers oblong, opening by two pores at the apex. Berry roundish, with 2, 3, 4, or 6 cells. Embryo spiral.

1. S. *nigrum*. Stem herbaceous, without thorns, erect. Leaves ovate, bluntly toothed for wavy. Umbels lateral drooping. —— *Waste places*. Flowers white. Berries black, poisonous.

[This very common plant has followed the footsteps of man over all the world, and has received many different names from incautious botanists. Sometimes the stems are furnished with narrow wings; but that too is only the mark of a variety. It is remarkable that in tropical countries the berries lose their deleterious qualities.]

Fig. CLXXVI.

Fig. CLXXV.—Solanum Dulcamara. 1. A flower; 2. a cross section of the ovary; 3. a section of the seed: *te.* testa, *ch.* chalaza, *alb.* albumen.

Fig. CLXXVI.—Solanum nigrum.

2. S. *Dulcamara.* Stem shrubby, zigzag, without thorns. Upper leaves hastate. Clusters cymose.———*Hedges, &c.* Flowers purple. Berries poisonous, bright red. There is also a white-flowered variety, and one with very downy leaves. Each lobe of the corolla has 2 green spots at the base.

Fig. CLXXVII.

3. S. *tuberosum* (*The Potato*). Roots creeping and tuberous. Stems winged. Leaves interruptedly pinnated, with somewhat heart-shaped, ovate, downy leaflets, oblique at the base. Flowers in terminal corymbs.———*Southern Chili. Everywhere cultivated.* The tubers of this plant are the Potatoes of Gardeners, by the vulgar often called the seed. In like manner the fruit is called the plum. The varieties of the plants are infinite, not only as regards the tubers but the manner of growth, size, form, and surface of the leaves and colour of the flowers: and should guard the student against imagining that in Natural History a difference is the same as a distinction.

4. S. *Melongena* (*Egg-plant, Egg-apple, Brinjal, Aubergine*). An annual, covered with tomentum. Stem erect, sometimes prickly. Leaves ovate-acuminate, somewhat repand or sinuated. Calyx prickly. Corolla 6—9 parted. Stamens 6—9.———*East Indies. Common in gardens,* under one or other of the above names. Fruit very large, white or purple, egg-shaped, smooth; in hot countries, when ripe, used as an esculent. Flowers violet.

5. S. *Lycopersicon* (*Love-apple, Tomato*). A green, straggling, hairy annual. Stem much branched. Leaves unequally and interruptedly pinnated, with incised segments. Flowers yellow.——*South America. Common in gardens.* Its fruit varies greatly in form, size, and colour; and usually contains many cells. It is employed in cookery, and in the preparation of sauces.

NICANDRA.

5-parted, 5-cornered, inflated. Corolla campanulate, with a plaited 5-lobed limb. Stamens 5, distinct, somewhat projecting; the filaments

Corolla

what unequal,

Fig. CLXXVII.—Solanum Dulcamara.

the corolla, as

HYOSCYAMUS.

Calyx tubular, 5-cleft. Corolla funnel-shaped; the limb spreading, obliquely 5-lobed, unequal. Stamens 5. Stigma capitate. Capsule compressed, furrowed on each side, opening at the apex by a transverse aperture.

1. H. *niger* (*Henbane*). Leaves sinuated, clasping the stem. Flowers sessile. —— *Commons, waste places.* Flowers dull yellow, with purple veins. A narcotic plant.

Fig. CLXXIX.

PHYSALIS.

Anthers opening lengthwise. Berry inclosed in a bladder-like calyx.

1. P. *Alkekengi* (*Winter Cherry*). Leaves in pairs, entire, acute. Stem herbaceous, branching from the base. Berries scarlet, inclosed in the permanent netted reddish brown calyx. Flowers white. ——*Gardens.*

Fig. CLXXV. the seed: *te.* test.

NICOTIANA.

Corolla funnel-shaped, with a plaited 5-lobed limb. Calyx permanent. Stigma capitate Capsule 4-valved at the apex, 2- to 4-celled, many-seeded.

1. N. *rustica* (*Turkish Tobacco*). Stem round. Leaves stalked, ovate, entire. Tube of the corolla cylindrical, as long as the calyx, the limb with rounded segments. ——— *Gardens.* Flowers green. This plant furnishes Latakia, or Syrian Tobacco.

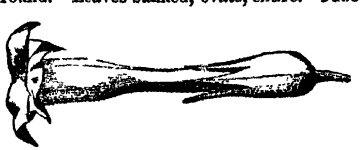

Fig. CLXXX.

2. N. *Tabacum* (*Virginian Tobacco*). Leaves lanceolate, taper pointed, decurrent. Corolla long, funnel-shaped, with the segments sharp pointed and turned downwards. ——— *Gardens.* Flowers pink.

*** In general the Tobaccos may be known by their heavy subaromatic smell, and by their leafstalks presenting a horse-shoe mark when cut across; but this also occurs in other plants of the order of Nightshades.

Fig. CLXXIX.—Hyoscyamus niger; *a*, its calyx
Fig. CLXXX.—Flower of Nicotiana Tabacum.

ORDER XLVI. SCROPHULARIACEÆ—LINARIADS.

ESSENTIAL CHARACTER.—*Calyx* inferior, persistent, often unequal. *Corolla* monopetalous, usually irregular; *limb* flat or erect, nearly equally divided or labiate. *Stamens* in a single series, 2 or 4, and not corresponding in number with the lobes of the corolla. *Ovary* superior, 2-celled, many-seeded; *style* simple or rarely bifid. *Fruit* capsular.—*Herbaceous* plants or *shrubs*, with exstipulate leaves. Very variable in their flowers.

*** The flowers are very like those of Labiatæ, but they have not a 4-lobed ovary: they also resemble a small order called Verbenaceæ, but are distinguished by their ovary containing more ovules than one in each cell.

SCROPHULARIA.

Calyx 5-lobed. Corolla globose: the limb contracted, 2-lipped; the upper lip 2-lobed, with an occasional intermediate scale; the lower shorter, and 3-lobed. Stigma simple. Capsule roundish acuminate; valves entire, turned inwards at the base.

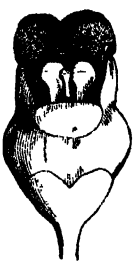

Fig CLXXX *b*

Fig CLXXX *c*

1. S. *nodosa*. Leaves heart-shaped, acute, 3-ribbed at the base. Stem sharp-edged. Root tuberous.———*Ditches.*

2. S. *aquatica*. Leaves heart-shaped, bluntish, on decurrent foot-stalks. Stem winged. Root fibrous ———*Ditches.*

DIGITALIS.

Calyx 5-parted, unequal. Corolla campanulate; the limb unequal, obliquely 4-lobed. Stigma simple or bilabiate. Capsule ovate, acuminate.

1. D. *purpurea* (*Foxglove*). Segments of the calyx ovate, acute. Corolla obtuse; its upper lobe scarcely cloven. Leaves downy.———*Waysides and gardens.*

EUPHRASIA.

Calyx 4-cleft. Corolla tubular, 2-lipped; the upper lip galeate, emarginate; the lower 3-lobed, equal. Anthers 2 or 4, acuminate at the base. Capsule ovate, compressed, obtuse, emarginate.

1. E. *officinalis* (*Eyebright*). Leaves ovate, with about 5 teeth on each side; the lowermost teeth closer together than the others. Upper lip of corolla 2-lobed, lower trifid with emarginate segments.———*Meadows, woods, heaths.*

PEDICULARIS.

Calyx tubular, inflated, 5-lobed, leafy. Upper lip of corolla compressed from the sides, curved; lower flat, 3-lobed. Ovules numerous. Capsule oblique, acute, compressed.

1. P. *sylvestris* (*Lousewort*). Stem branched from the base, and spreading. Calyx angular, smooth, with 5 unequal crenate leafy lobes.———*Moist pastures,* &c. Flowers purple.

2. P. *palustris*. Stem solitary, erect. Calyx broad, hairy, ribbed, with crenated nearly equal lobes.——*Wet pastures.* Flowers purple.

Fig. CLXXX *b*.—Flower of Scrophularia. Fig. CLXXX. *c*.—Digitalis purpurea.

ANTIRRHINUM.

Calyx 5-parted. Corolla without a spur, gibbous at the base; the tube inflated; the limb 2-lipped; the upper lip bifid and reflexed; the lower 3-lobed, with a projecting palate. Capsule oblique at the base, dehiscing by small holes at the apex.

Fig. CLXXXII.

1. A. *majus (Snapdragon)*. Flowers in a dense cluster. Leaves lanceolate. Segments of the calyx ovate, obtuse.——*Old walls, gardens.*

LINARIA.

Calyx 5-parted; the 2 lower segments far apart from the rest. Corolla ringent, calcarate at the base; the tube inflated; the limb 2-lipped; the upper lip bifid, reflexed; the lower 3-lobed. Capsule ovate or globose, opening with several valves at the apex.

1. L. *vulgaris (Toadflax)*. Leaves linear-lanceolate, crowded. Stem erect. Spikes terminal. Flowers imbricated. Calyx smooth, shorter than the spur.——*Hedgerows, banks, woods.*

2. L. *Cymbalaria*. Leaves heart-shaped, 5-lobed, alternate smooth. Stems procumbent.——*Gardens.*

Fig. CLXXXIII.

Fig. CLXXXII.—Antirrhinum majus. 1. A flower split open, showing the didynamous stamens;

VERONICA.

Calyx 4- or 5-parted. Corolla rotate; the limb 4-parted, unequal, with entire lobes. Stamens 2. Capsule either separable in 2, or bearing the septa in the middle of the valves.

1. V. *Beccabunga* (*Brooklime*). Stem creeping. Leaves elliptical, flat, obtuse, crenated. Racemes axillary. Capsule roundish, slightly emarginate. ———*Ditches.*

2. V. *officinalis* (*Speedwell*). Clusters lateral; partial stalks shorter than their bracteæ. Leaves elliptical, serrated, roughish. Stem procumbent Stigma capitate.———*Commons, pastures, &c.*

3. V. *arvensis.* Flowers solitary, nearly sessile. Leaves cordate-ovate, deeply serrated; the floral ones lanceolate, entire. Pedicels erect. Seeds flat.———*Waste places.*

4. V. *hederifolia.* Flowers solitary, on long stalks. Leaves heart-shaped, flat, 5-lobed. Segments of the calyx heart-shaped, acute. Seeds cupped, wrinkled. Capsule 4-lobed, globose.———*Waste places.*

Fig. CLXXXIV.

OROBANCHE.

Calyx 1- or 2-parted, with from 1 to 3 bracteæ. Corolla tubular, ringent, 4- or 5-cleft. Stamens 4, didynamous. Ovarium surrounded by a fleshy disk. Style 1. Stigma capitate, emarginate, 2-lobed.

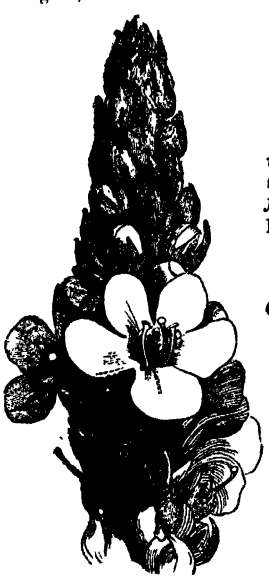

Fig CLXXXIV *b.*

1. O. *major* (*Broom-rape*). Stem simple. Corolla inflated; upper lip slightly notched; lower with acute, nearly equal segments. Stamens quite smooth below.———*Heaths and fields; parasitic on the roots of plants.* A brown leafless plant.

VERBASCUM.

Calyx 5-parted. Corolla rotate, 5-lobed, unequal. Stamens 5, unequal; filaments declinate, almost always villous at the base. Capsule with 2 valves, ovate, or globose.

1. V. *Thapsus* (*Mullein*). Leaves decurrent, crenate, woolly on both sides. Stem simple. Cluster dense. Flowers almost sessile.———*Waysides.*

2. V. *nigrum.* Leaves oblong-heart-shaped, stalked, waved, and crenate, slightly downy. Cluster mostly solitary.———*Waysides.*

Fig. CLXXXIV.—Veronica hederifolia.
Fig CLXXXIV. *b.*—Verbascum Thapsus

ORDER XLVII. LENTIBULARIACEÆ—BUTTERWORTS.

ESSENTIAL CHARACTER.—*Calyx* persistent, inferior. *Corolla* monopetalous, hypogynous, irregular, bilabiate, with a spur. *Stamens* 2, included within the corolla, and inserted into its base; *anthers* 1-celled, sometimes contracted in the middle. *Ovary* 1-celled; *style* 1, very short; *stigma* bilabiate. *Capsule* 1-celled, many-seeded, with a large central placenta.—*Herbaceous* plants, living in water or marshes. *Leaves* radical, undivided; or compound, resembling roots, and bearing little vesicles. *Scapes* either with minute stipule-like scales, or naked; sometimes with whorled vesicles; generally undivided. *Flowers* single, or in spikes, or in many-flowered racemes; with a single bract, rarely without bracts.

PINGUICULA.

Calyx campanulate. 5-cleft. Corolla 2-lipped; the upper 3-lobed; the lower 2-lobed, shorter, and spurred. Stigma bilabiate.

1. P. *vulgaris* (*Butterwort*). Spur cylindrical acute, as long as the very irregular corolla. Segments of the calyx oblong. Capsule ovate.———*Bogs.* Flowers blue.

UTRICULARIA.

Calyx 2-leaved; the lips equal and undivided. Corolla personate; the lower lip spurred at the base. Stamens 2, the filaments bearing the anthers on their inner face at the top. Stigma bilabiate.

1. U. *vulgaris.* Spur conical. Stalk straight. Raceme somewhat corymbose. Upper lip of the corolla the length of the palate, reflexed at the sides.———*Bogs and wet ditches.* Flowers yellow.

ORDER XLVIII. PLANTAGINACEÆ—RIBWORTS.

ESSENTIAL CHARACTER.—*Flowers* usually hermaphrodite, very much imbricated. *Calyx* 4-parted, persistent. *Corolla* membranous, monopetalous, hypogynous, persistent, with a 4-parted limb. *Stamens* 4, inserted into the corolla, alternately with its segments; *filaments* filiform, flaccid, doubled inwards in æstivation; *anthers* versatile, 2-celled. *Ovary* sessile, without a disk, 2-, very seldom 4-celled, the cells caused by the growth of a free central placenta; *ovules* peltate or erect, solitary, twin, or indefinite; *style* simple, capillary; *stigma* hispid, simple, rarely half-bifid. *Capsule* membranous, dehiscing transversely. *Seeds* sessile, peltate, or erect, solitary, twin, or indefinite; *testa* mucilaginous; *embryo* in axis of fleshy albumen; *radicle* inferior; *plumula* inconspicuous.—*Herbaceous* plants, with inconspicuous flowers, often arranged in heads or imbricated spikes.

*** The long weak stamens are in general an obvious mark of this order.

PLANTAGO.

Flowers hermaphrodite. Capsule with 2 or 4 cells, and 2 or several seeds.

1. P. *major.* Leaves ovate, smoothish, somewhat toothed, on longish foot-stalks. Flower-stalks round. Spike tapering. Seeds numerous.———*Banks and pastures.*

2. P. *lanceolata* (*Ribgrass* or *Plantain*). Leaves lanceolate, entire, tapering at each end, woolly at the base. Flower-stalks angular. Spike ovate.———*Waste places, waysides, pastures.*

3. P. *Coronopus.* Leaves in many pinnate linear segments. Flower-stalks round.———*Waste places.*

ORDER XLIX. PLUMBAGINACEÆ—LEADWORTS.

ESSENTIAL CHARACTER.—*Calyx* tubular, plaited, persistent. *Corolla* monopetalous or 5-petalous, regular. *Stamens* definite, opposite the petals; in some species hypogynous! in others arising from the petals! *Ovary* superior, single, 1-seeded; *ovule* inverted, pendulous from the point of an umbilical cord, arising from the bottom of the cavity; *styles* 5! seldom 3 or 4: *stigmas* the same number. *Fruit* a nearly indehiscent utricule. *Seed* inverted.—*Herbaceous* plants or *under-shrubs*, variable in appearance. *Leaves* alternate or clustered, undivided, somewhat sheathing at the base. *Flowers* either loosely panicled, or contracted into heads, flowering irregularly.

*** This order will not be mistaken, if attention is paid to its having 5 styles, and a 1-celled, 1-seeded superior ovary.

Calyx scarious, plaited, entire. Corolla monopetalous, or pentapetalous. Stamens 5, inserted on the lobes of the corolla. Styles 5. Fruit indehiscent. Flowers capitate, in solitary heads, surrounded by a common imbricated scarious involucre. Leaves radical, tufted.

1. A. *maritima (Common Thrift)*. Leaves linear, flat, obtuse. Scape twice 3 or 4 times as long as the leaves. Scales of the involucrum scarious, obovate, very obtuse, shorter than the flowers. Calyx hairy at the base, with 5 sharp teeth shorter than the corolla.——— *Gardens.*

Flowers in loose panicles, arranged on one side of the branches in long rows, surrounded by scarious scales. Otherwise the same as Armeria.

1. S. *Limonium (Sea Lavender)*. Stalks round. Spikes level-topped. Leaves elliptic-oblong, single-ribbed, smooth, with a nearly terminal bristle.——— *Salt Marshes.*

The following additional corollifloral orders are found in Europe, but they contain few species, and are of less importance than the preceding:—

PYROLACEÆ—WINTER-GREENS.

ESSENTIAL CHARACTER.—Most of the characters of Ericaceæ, but: *Disk* absent; *seeds* very minute, enclosed in a tubular reticulated skin, which is much larger than they are.

*** A few pretty little herbaceous plants, with white or pink flowers, and roundish coriaceous deep-green leaves, are occasionally met with in moist woods, especially in northern or subalpine situations. They all belong to the genus *Pyrola.*

MONOTROPACEÆ.—FIR-RAPES

ESSENTIAL CHARACTER.—The same as Pyrolaceæ, except: *Style* straight; *anthers* bursting longitudinally; *stems* leafless, or nearly so, but covered with fleshy scales.—*Parasitical* plants.

*** *Monotropa Hypopithys*, a colourless plant, found among half-decayed leaves in woods, is the only European species of this small order. It is known from Orobanche by its stamens not being didynamous, nor its flower irregular, nor its ovary 2-celled. And from Neottia by being an Exogen, with a superior not inferior ovary.

AQUIFOLIACEÆ—HOLLYWORTS, OR AQUIFOILS.

ESSENTIAL CHARACTER.—*Sepals* 4 to 6, imbricated. *Corolla* 4- or 5-parted, hypogynous, imbricated. *Stamens* inserted into the corolla, alternate with its segments; *filaments* erect. *Disk* none. *Ovary* fleshy, superior, with from 2 to 6 cells; *ovules* solitary, pendulous; *stigma* subsessile, lobed. *Fruit* fleshy, indehiscent, with from 2 to 6 stones.—*Trees* or *shrubs*. *Leaves* alternate or opposite, coriaceous. *Flowers* small, axillary, solitary, or fascicled.

*** The *Holly-tree* (*Ilex Aquifolium*) is the only common plant belonging to this order, which has no very close resemblance to any other European group

Fig CLXXXIV. *c*.

Fig CLXXXIV. *c*.—Ilex Aquifolium; with a magnified view of its flower.

OLEACEÆ—OLIVEWORTS.

ESSENTIAL CHARACTER.— *Calyx* monophyllous, divided, persistent, inferior. *Corolla* 4-cleft, occasionally of 4 petals, sometimes without petals; *æstivation* valvate (or in Phillyrea imbricated). *Stamens* 2. *Ovary* simple, without any hypogynous disk, 2-celled; the *cells* 2-seeded; the *ovules* pendulous and collateral. *Fruit* drupaceous, berried, or capsular, often by abortion 1-seeded. — *Trees* or *shrubs*. *Branches* usually dichotomous and ending abruptly by a conspicuous bud. *Leaves* opposite, simple, sometimes pinnated. *Flowers* in terminal or axillary racemes or panicles.

*** Several European plants belong to this order, which is known at once, by its regular diandrous flowers, from all other European groups, except *Jasminaceæ*, and from them by the corolla being valvate not imbricated. The *Lilac* (*Syringa vulgaris*), *Olive* (*Olea europœa*), *Privet* (*Ligustrum vulgare*), and *Phillyrea*, all common in gardens, belong to the order; as also does the *Ash-tree* (*Fraxinus excelsior*), which is, however, anomalous in its structure, having no corolla in the common species; the corolla does, however, exist in the *Manna Ash* (*Ornus rotundifolia*).

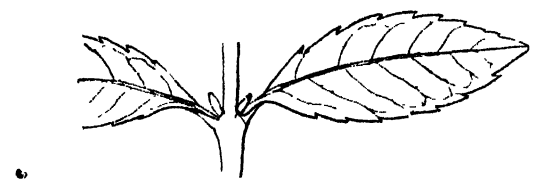

Fig. CLXXXV

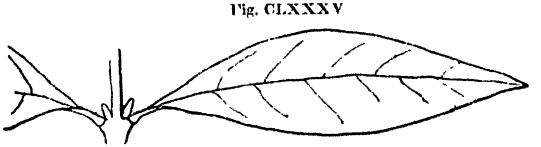

Fig. CLXXXVI

Fig. CLXXXV.—Phillyrea latifolia Fig. CLXXXVI.—Ligustrum vulgare.

LOBELIACEÆ— LOBELIADS.

ESSENTIAL CHARACTER. — The only differences between this order and Campanulaceæ are, that its flowers are irregular instead of regular, and the anthers at the same time syngenesious. It is a large order out of Europe, but is extremely uncommon in this quarter of the globe. A little water-plant called *Lobelia Dortmanna* is British.

APOCYNACEÆ—DOGBANES.

ESSENTIAL CHARACTER. — *Calyx* divided into 5, persistent. *Corolla* monopetalous, hypogynous, regular, 5-lobed, with contorted æstivation, deciduous. *Stamens* 5, arising from the corolla; *filaments* distinct; *anthers* 2-celled, opening lengthwise; *pollen* granular, globose, or 3-lobed, immediately applied to the stigma. *Ovaries* 2, polyspermous; *styles* 2; *stigma* 1. *Fruit* a double follicle. — *Trees* or *shrubs*, usually milky. *Leaves* opposite,

sometimes whorled, seldom scattered, quite entire, often having ciliæ or glands upon the petioles, but with no stipules.

*** The *Periwinkles, Vinca major* and *minor*, common trailing shrubby evergreens, and an *Apocynum* or two, are the plants of this order which inhabit Europe. They are readily known by their opposite leaves, and bifollicular fruit, from all orders except Asclepiadaceæ; and from that order by their separate anthers having powdery pollen.

JASMINACEÆ—JASMINEWORTS.

ESSENTIAL CHARACTER.—These plants differ from Oleaceæ in having the corolla imbricated in æstivation, and erect ovules. The common white Jasmine (*Jasminum officinale*) sufficiently illustrates the structure of the remainder.

POLEMONIACEÆ.

ESSENTIAL CHARACTER.—*Calyx* monosepalous, permanent. *Corolla* hypogynous, regular, 5-cleft, imbricated. *Stamens* 5, inserted on the tube of the corolla. *Ovary* superior, 3-celled, with ascending or peltate ovules; *stigma* trifid. *Capsules* 3-valved, with a loculicidal dehiscence. ——— *Herbaceous* plants.

*** The only European genus is *Polemonium*, of which one species, *P. cæruleum*, or the *Jacob's Ladder*, also called *Greek Valerian*, a biennial with white or blue flowers, is common in gardens. The order differs from *Convolvulaceæ* in not having a broken-whorled calyx.

—VERVAINS.

ESSENTIAL CHARACTER. — *Calyx* tubular, persistent, inferior. *Corolla* hypogynous, monopetalous, tubular, deciduous, generally irregular. *Stamens* usually 4, didynamous, seldom equal, occasionally 2. *Ovary* 2- or 4-celled; *ovules* erect or pendulous, solitary or twin; *style* 1; *stigma* bifid or undivided. *Fruit* nucamentaceous, composed of two or four nucules in a state of adhesion. *Seeds* erect or pendulous. — *Trees* or *shrubs*, sometimes *herbaceous* plants. *Leaves* generally opposite, simple or compound, without stipules. *Flowers* in opposite corymbs, or spiked alternately; sometimes in dense heads; very seldom axillary and solitary.

*** The common *Vervain* (*Verbena officinalis*), a way-side weed, is all that the European Flora comprehends of this order, which differs from Labiatæ only in the 4 lobes of the ovary of that order being consolidated in this.

ACANTHACEÆ—ACANTHS.

ESSENTIAL CHARACTER.—*Calyx* 5-leaved, very much imbricated. *Corolla* monopetalous, hypogynous, bearing the stamens, irregular; the *limb* 2-lipped. *Stamens* mostly 2, both bearing anthers; sometimes 4, didynamous. *Ovary* seated in a disk, 2-celled, the cells either 2- or many-seeded; *style* 1; *stigma* 2-lobed, rarely undivided. *Capsule* 2-celled, the cells 2- or many-seeded, bursting elastically with 2 valves. *Seeds* roundish, hanging by ascending processes of the placenta, hard, cup-shaped, or usually hooked.

*** Scarcely different from Scrophulariaceæ, except in the seeds having no albumen, and hanging to the placenta by indurated funiculi, and by the very much imbricated or broken-whorled calyx. *Acanthus*, consisting of Greek herbaceous plants, and the only European genus, is a bad type of the order, which is abundant in tropical countries, and hardly belongs to the European Flora.

CHAPTER VII.

OF MONOCHLAMYDEOUS EXOGENS.

The following are the most important orders of this sub-class in the Flora of Europe, viz.—

Sanguisorbeæ; Chenopodiaceæ; Polygonaceæ; Elæagnaceæ; Thymelaceæ; Euphorbiaceæ; Urticaceæ; Corylaceæ; Salicaceæ; Betulaceæ; Ulmaceæ; Coniferæ.

The following short characters explain the distinctions between these orders:

Sanguisorbeæ. Calyx tubular, lined with a disk, on the outside of which the stamens are inserted. Carpel solitary, simple, 1-seeded; when ripe enclosed in the hardened tube of the calyx. Stipules leafy

Stamens opposite the sepals. Carpel solitary, simple, 1-seeded; when ripe a utricle. No stipules.

Polygonaceæ. Stamens not regularly opposite the sepals. Carpel solitary, simple, 1-seeded; when ripe a 3-cornered nut. Stipules ochreate.

Elæagnaceæ. Flowers unisexual Calyx tubular, with the stamens on its tube. Carpel solitary, simple, with an ascending ovule; when ripe a nut enclosed within the succulent calyx. Leaves scurfy.

Thymelaceæ. Calyx tubular; with the stamens on its tube. Carpel solitary, simple, with suspended ovule, 1-seeded; when ripe a nut or a drupe. Leaves smooth.

Euphorbiaceæ. Flowers unisexual. Carpels 3, united into a pistil, which, when ripe, separates with elasticity into 3 shells or cocci.

Urticaceæ. Flowers unisexual. Stamens opposite the sepals and elastic. Carpel solitary, simple, 1-seeded; when ripe an achænium.

Corylaceæ. Flowers unisexual; the males in aments. Carpels 2 or more, inferior, united into a many-celled pistil, which, when ripe, becomes 1-celled and 1-seeded, and is enclosed in a cupule.

Salicaceæ. Flowers unisexual, amentaceous. Carpels 2, united into a 1-celled pistil, with numerous ovules, which, when ripe, become seeds tufted with fine hairs.

Betulaceæ. Flowers unisexual, amentaceous. Carpels 2, united into a 2-celled pistil, which, when ripe, becomes membranous, with a single seed in each cell.

Ulmaceæ. Flowers bisexual, not amentaceous. Calyx lacerated, membranous. Carpels 2, united into a 2-celled pistil, which, when ripe, becomes membranous, with a single seed in each cell.

Coniferæ. Flowers unisexual, amentaceous. Carpels opening out into scales, collected into cones or heads, or solitary, upon which grow the naked ovules.

TABULAR VIEW OF THE PRECEDING NATURAL ORDERS.

A *Flowers not amentaceous.*
- *a.* Carpel solitary, simple.
  - α Fruit a round nut, enclosed in the hardened tube of the calyx: *Sanguisorbeæ.*
  - β. Fruit a round nut, enclosed in the succulent tube of the calyx: *Elæagnaceæ.*
  - γ. Fruit a triangular naked nut: *Polygonaceæ.*
  - δ. Fruit naked, a drupe or round nut: *Thymelaceæ.*
  - ε. Fruit a lenticular seed-like nut: *Urticaceæ.*
  - ζ. Fruit a utricle . *Chenopodiaceæ.*
- *b.* Carpels more than one, consolidated.
  - a. Flowers unisexual. Carpels 3: *Euphorbiaceæ.*
  - Flowers bisexual. Carpels 2: *Ulmaceæ.*

B *Flowers amentaceous.*
- *a* Carpels inferior, 2- or more celled, enclosed in a cupule . . *Corylaceæ.*
- *b.* Carpels superior, closed up, 1-celled, many-seeded . . . . *Salicaceæ.*
- *c.* Carpels superior, closed up, 2-celled, 2-seeded . . . . . *Betulaceæ.*
- *d.* Carpels opened out, with naked ovules *Coniferæ.*

ORDER I. SANGUISORBEÆ—SANGUISORBS.

ESSENTIAL CHARACTER.—*Flowers* often unisexual. *Calyx* with a thickened tube and a 3-, 4-, or 5-lobed limb, its tube lined with a disk. *Stamens* definite or 00, sometimes fewer than the segments of the calyx, and arising from its orifice. *Ovary* solitary, simple, with a style proceeding from the apex or the base; *ovule* solitary, always attached to that part of the ovary which is next the base of the style. *Nut* solitary, enclosed in the (often indurated)

tube of the calyx. *Seed* solitary, suspended or ascending.—*Herbaceous* plants or *under-shrubs*, occasionally spiny. *Leaves* simple and lobed, or compound, alternate, with stipules. *Flowers* small, often capitate.

*** If petals were added to this order it would belong to Rosaceæ, with which it is therefore generally united.

ALCHEMILLA.

Calyx 4-toothed, with 4 external bracteolæ. Stamens 1 to 4. Nuts 1 to 2. Stigmas capitate Seed suspended.—Herbaceous plants. Leaves palmate, lobed, or cut. Flowers herbaceous.

1. A. *vulgaris* (*Ladies' Mantle*). Leaves lobed, plaited serrated, the radicle reniform and half-orbicular. Flowers terminal, corymbose. ——— *Gardens.*

2. A. *arvensis* (*Parsley Piert*). Leaves flat, 3-lobed, cut, wedge-shaped at the base. Flowers axillary, clustered. ——— *Gravelly waste places.* A little insignificant weed, which is easily overlooked in the gravelly places where it grows.

POTERIUM.

Flowers monœcious or polygamous. Calyx 4-toothed, with 3 scales on the outside at the base. Stamens 20 to 30. Nuts 2. Stigma pencil-shaped. Seed suspended.—Herbaceous plants. Leaves unequally pinnate. Flowers in dense spikes.

1. P. *Sanguisorba* (*Burnet*). Stem somewhat angular, herbaceous. Leaves pinnated; leaflets ovate-roundish. Spikes globose. Calyx, when in fruit, bony, netted, with 4 obtuse angles. ——— *Pastures, gardens.* Sometimes cultivated for sheep-food.

ORDER LI. CHENOPODIACEÆ—CHENOPODS.

ESSENTIAL CHARACTER.—*Calyx* herbaceous, sometimes tubular at the base; or none. *Stamens* inserted into the base of the calyx, opposite its segments. *Ovary* single, superior, or occasionally adhering to the tube of the calyx, with a single *ovule* attached to the base of the cavity; *style* in 2 or 4 divisions, rarely simple. *Fruit* membranous, sometimes baccate.—*Herbaceous* plants or *under-shrubs*. *Leaves* alternate without stipules, occasionally opposite. *Flowers* small, sometimes polygamous.

*** Distinguished from Urticaceæ by the want of stipules chiefly; and by their seed having an inferior radicle; from Polygonaceæ by the former character, and the fruit not being triquetrous.

CHENOPODIUM.

Calyx 3-, 4, or 5-parted, persistent, neither warted nor growing together after flowering. Stamens 5 or fewer. Style 2-fid. Stigmas 2 to 4. Fruit a thin utricle, containing a single polished brittle seed.

1. C. *album* (*Goosefoot*). Leaves rhomboid-ovate, jagged, mealy; entire towards the base, upper ones oblong entire. Fruit quite smooth. ——— *Waste places.*

2. C. *Bonus* (*Henricus*). Leaves triangular-arrow-shaped, entire. Spikes terminal, compound, leafless. ——— *Waste places.* Formerly employed for the same purposes as Spinach is applied to now.

BETA.

Calyx 5-parted, half-adhering to the ovarium at the base Stamens 5. Styles 2. Fruit reniform, enveloped in the capsular base of the calyx.

1. B. *vulgaris* (*Garden Beet*). Roots fusiform, very fleshy, biennial. Radical leaves ovate, obtuse, somewhat cordate; those of the stem rhomboid-ovate. Spikes leafy. —— *Gardens.*

ATRIPLEX.

Polygamous, or often monœcious.—*Hermaphrodite.* Calyx 5-parted. Stamens 5. Pistillum usually defective.—*Female.* Calyx 2-parted; the segments parallel and close together, uniting after flowering, and forming a cover for the fruit. Style bifid. Fruit a utricle, with a single brittle seed.

1. A. *patula*. Stem herbaceous, spreading. Leaves triangular-lanceolate, somewhat halberd-shaped. Calyx of the fruit tuberculated at the sides.——*Waste places.*

2. A. *hastata*. Stem herbaceous. Lower branches straggling. Leaves whole-coloured, the lower triangular-hastate, deeply toothed, the uppermost entire, those between them hastate-lanceolate. Fruit cordate triangular, with acuminate teeth.——*Waste places.*

3. A. *hortensis* (*Garden Orache*). Stem herbaceous, erect. Leaves cordate-triangular, toothed, whole-coloured. Fruit roundish-ovate, shortly acuminate, netted, entire.——*Gardens.*

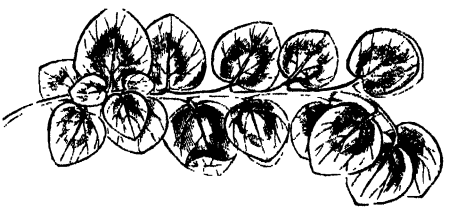

Fig. CLXXXVI. *b*.

SPINACIA.

Flowers dioecious.—*Male*. Calyx 4-parted. Stamens 4, inserted in the bottom of the calyx.—*Female*. Calyx 2- or 3-cleft. Styles 4. Fruit consolidated with the hardened calyx.

1. S. *oleracea* (*Garden Spinage*). Leaves oblong-ovate. Fruit unarmed or spiny.——*Gardens.*

SALICORNIA.

Calyx fleshy entire, sunk in an excavation of the rachis. Stamens 1 or 2. Fleshy, leafless, jointed plants.

1. S. *annua* (*Saltwort*). Stem herbaceous. Calyxes placed in a triangle.——*Wild in salt marshes, common.* Often sold in the markets, for pickling, under the erroneous name of Samphire. Its ashes, when burnt, furnish kelp, or crude soda.

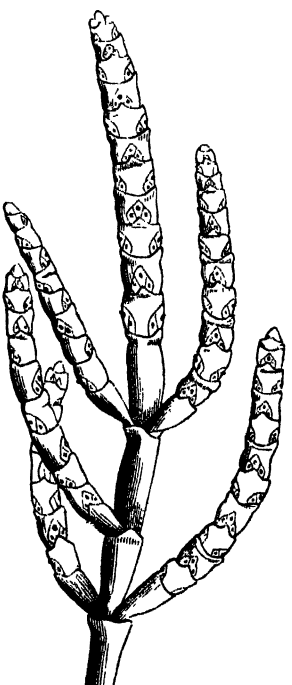

Fig. CLXXXVI. *c*.

ORDER LII. POLYGONACEÆ.—BUCKWHEATS.

ESSENTIAL CHARACTER.—*Calyx* inferior, imbricated in æstivation. *Stamens* definite, inserted in the calyx. *Ovary* superior, with a single erect ovule; *styles* or *stigmas* several. *Nut* triangular, naked, or protected by the calyx. *Seed* with farinaceous albumen, rarely with scarcely any.—*Herbaceous* plants, rarely *shrubs*. *Leaves* alternate, their stipules cohering round the stem in the form of an ochrea: when young, rolled backwards. *Flowers* occasionally unisexual, often in racemes.

*** The 3-cornered fruit, combined with ochreate stipules, are certain signs of this natural order; but Alchemilla is ochreate, and therefore the character derived from the stipules cannot be taken alone.

Fig. CLXXXVI. *b*.—Ripe fruits of Atriplex hortensis.
Fig. CLXXXVI *c*.—Salicornia annua.

POLYGONUM.

Flowers hermaphrodite. Calyx monophyllous, divided, persistent, generally petaloid. Stamens definite, either equal in number to the segments of the calyx, or twice as

Fig. CLXXVI *d*.—Polygonum Bistorta.

at the base; anthers opening longitudinally. Ovary 3—5-celled, with solitary placentæ. Berry dry, inclosed in the inflated calyx.

1. N. *physaloides*. A tall annual. Stem erect, with angular branches. Leaves smooth, ovate-oblong, sinuated, wedge-shaped at the base, and decurrent on the petiole. Flowers solitary; blue with a white bottom and 5 blue rays.——*Peru. Common in gardens* under the name of Atropa physaloides and Alkekengi, by which it is also known in seed-shops.

Fig. CLXXVIII.

ATROPA.

Calyx campanulate, 5-cleft. Corolla campanulate, twice as long as the calyx, 5-lobed, equal. Filaments 5, filiform. Berry globose, seated in the calyx.

1. A. *Belladonna* (*Deadly Nightshade*). Stem herbaceous. Leaves ovate, undivided. Flowers solitary.——*Woods*. Flowers large, livid purple. Fruit resembling black cherries, very poisonous, but used in medicine as a valuable narcotic.

Fig. CLXXVIII.—Atropa Belladonna. 1. Flower opened; 2. transverse section of ripe fruit.

SCOPOLINA.

Corolla tubular-campanulate, 5-lobed. Capsule globular, cut round at the base.

1. S. *atropoides*. Leaves light green, shining. Flowers brown, shining externally; dull and pale olive green in the inside.———*Germany*. Common in botanical gardens, where it is called Hyoscyamus Scopolia. Flowers among the earliest herbaceous plants.

CAPSICUM.

Calyx rather angular, shallow, 5—6-toothed. Corolla rotate, with a 5—6-cleft limb. Stamens projecting; anthers cordate, free, opening longitudinally. Ovary 2—4-celled. Fruit a juiceless berry.

1. C. *annuum* (*Capsicum; Tchilli or Chilli*). An annual plant. Leaves elliptical or ovate, acuminate, entire, smooth. Flowers white with yellow anthers.———. *Tropical America. Common in gardens.* The fruit varies much in form and size, but is always either red or yellow. It is extremely peppery; and, with the seeds, forms, when ground, the condiment called Cayenne Pepper.

DATURA.

Calyx tubular, ventricose, with 5 angles, 5-toothed, deciduous, leaving behind a broad orbicular base. Corolla funnel-shaped; the tube long; the limb with 5 angles, 5 plaits, and 5 points. Stamens 5; Stigma of 2 plates. Capsule echinate or smooth, 2-celled; the cells divided occasionally by spurious dissepiments.

1. D. *Stramonium* (*Thorn Apple*). Fruit spinous, ovate, erect. Leaves ovate, smooth, sinuated.———*Waste places*. Flowers large, white. A powerful narcotic.

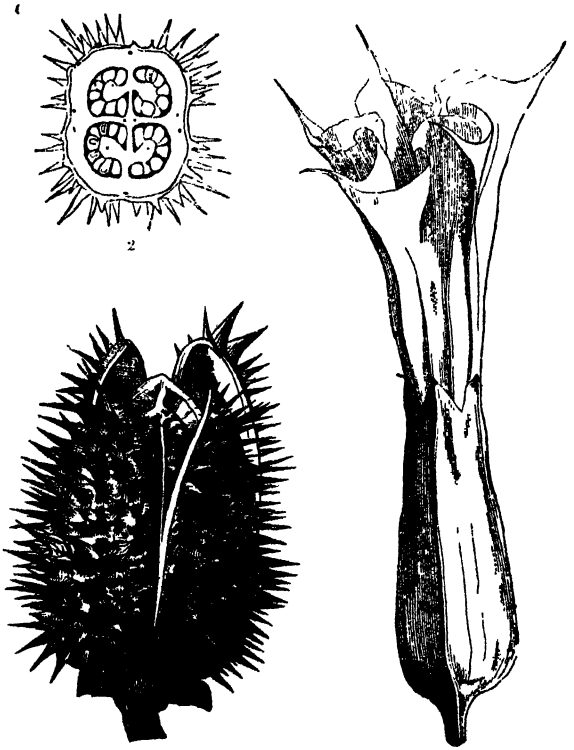

Fig. CLXXVIII. *b*.

Fig. CLXXVIII. *b*.—Datura Stramonium. 1. Flower; 2. section of ovary; 3. ripe fruit.

many, but generally in part abortive. Fruit a 2- or 3-cornered, indehiscent, monospermous nut.

1. P. *amphibium*. Styles 2, united half way up. Stamens 6. Racemes dense, ovate-oblong, erect, on smooth stalks. Stipules fringed.———*Wet places.*

2. P. *Fagopyrum* (*Buckwheat*). Leaves heart-arrow-shaped. Stem nearly upright, without prickles. Angles of the fruit even.———*Fields, cultivated.* Flour of the seeds, or albumen, eatable.

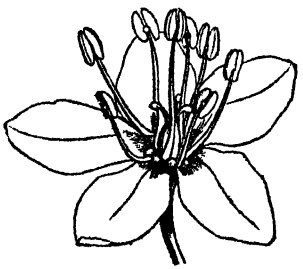

Fig. CLXXXVI. *e*.

3. P. *Hydropiper*. Styles 2, united half way up. Stamens 6. Racemes lax, interrupted, drooping. Stem erect. Leaves lanceolate, wavy, without spots.———*Wet ditches, &c.*

4. P. *aviculare* (*Knot-grass*). Flowers axillary. Leaves elliptic-lanceolate, rough-edged. Ribs of the stipules distant. Stem procumbent, herbaceous.———*Dry places, gravel walks, &c.* A worthless weed: its seeds are said to produce sickness.

5. P. *Convolvulus*. Leaves heart-arrow-shaped. Stem twining, angular. Segments of the calyx bluntly keeled.———*Hedges and fields.*

Fig. CLXXXVII.

6. P. *Bistorta* (*Bistort*). Leaves oblong-ovate, rather cordate, and wavy; petioles winged. Flowers in an oblong terminal spike.———*Damp meadows.* Root a powerful astringent.

7. P. *Persicaria*. Root annual, fibrous. Leaves lanceolate, blotched with dull purple, with loose long-fringed stipules. Flowers in compact ovate-oblong cylindrical spikes. Calyx glandular. Stamens 6. Styles 2—3, united up to the middle.——— *Common in wet places.* Stems 1—2 feet high. Flowers rose-coloured.

N.B. This is very different from the Persicaria sold in seedshops, which is a beautiful annual called *Polygonum orientale.*

Fig. CLXXXVI *e*.—Flower of Polygonum Fagopyrum.
Fig. CLXXXVII.—Polygonum Hydropiper.

Calyx 6-parted; the 3 outer segments somewhat cohering at the base; the 3 inner becoming enlarged after flowering. Stamens 6. Styles 3, reflexed. Stigmas 3, cut. Nut with three sharp angles. Embryo on one side.

1. R. *obtusifolius* (*Dock*). Lower leaves cordate-ovate, obtuse, seldom roundish, slightly curled; the upper ovate-lanceolate, tapering to each end, obtuse, on long stalks. Flowering branches alternate, or rarely double. Whorls distant, many-flowered, axillary. Inner sepals becoming ovate, acute, entire, or with 2 or 3 slight teeth, each bearing a large tubercle.——*Waste places.*

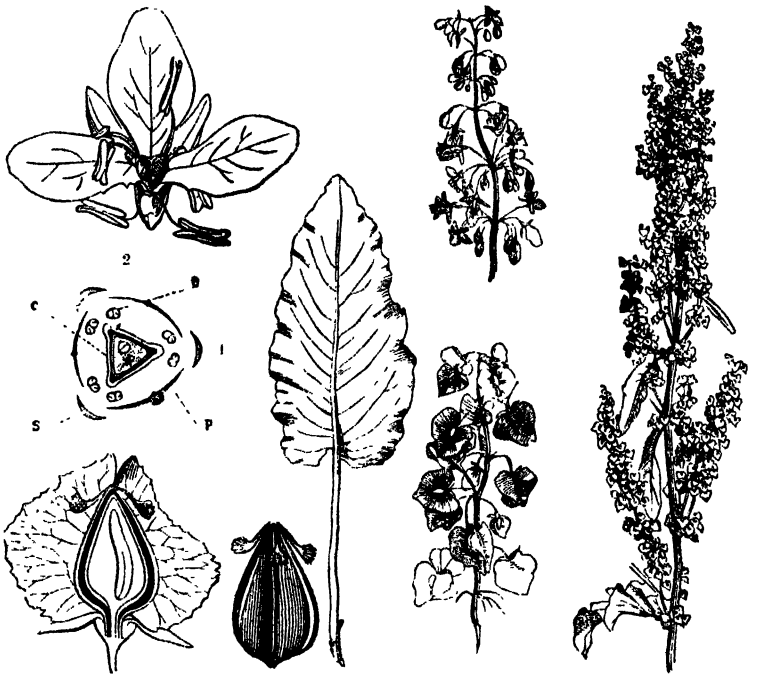

Fig. CLXXXVIII.

2. R. *crispus*. Leaves wavy, curled, acute; the lower oblong-lanceolate, stalked. Flowering branches alternate, double or triple, simple or divided. Whorls somewhat clustered, many-flowered; the upper destitute of leaves. Inner sepals becoming roundish, cordate, entire, acute, with very large tubercles.——*Waste places.*

3. R. *Acetosa* (*Sorrel*). Flowers dioecious. Leaves oblong, arrow-shaped. Permanent sepals tuberculated.——*Meadows and pastures.*

ORDER LIII. ELÆAGNACEÆ—OLEASTERS.

Essential Character.—*Calyx* inferior, coloured inside, 2- or 4-cleft, imbricated in æstivation. *Stamens* inserted into the throat of the calyx, equal in number to its divisions, or twice as many. *Ovary* enclosed in the tube of the calyx, superior, with a single erect ovule; *style* 1; *stigma* 1. *Fruit* a dry or fleshy drupe.—*Shrubs* or small *trees;* the *leaves* covered over with scurfiness.

Fig. CLXXXVIII.—Rumex crispus. 1. A diagram of its flower: *s*, *p*, outer and inner sepals, *c* stamens, *c* carpels: 2. the flower; 3. a vertical section of the pistil, &c.; 4. the pistil separate.

*** We have no shrubby plants with scurfy leaves in Europe, except such as belong to this order.

HIPPOPHAE.

Flowers dicœcious —*Male*, catkin-like, tetrandrous. *Female*, axillary, solitary. Calyx tubular, bifid, and closed at the apex. Disk wanting. Fruit a nut, contained within a succulent calyx.

1. H. *Rhamnoïdes* (*Sea Buckthorn*). Leaves linear-lanceolate, alternate.——— *Sea coast.* A spiny shrub.

ELÆAGNUS.

Flowers hermaphrodite. Tube of calyx slender; limb campanulate, 4- or 5-cleft, the throat contracted by a fleshy ring. Stamens 4 or 5. Fruit drupe-like, formed of the fleshy calyx-tube, enclosing a long nut.

1. E. *angustifolia* (*Oleaster*). Leaves lanceolate, acute, entire, silvery on each side. Flowers axillary, stalked, erect, solitary or in threes.———*Gardens.* Flowers pale yellow, very sweet-scented. Often called Bohemian Olive.

ORDER LIV. THYMELACEÆ—DAPHNADS.

Essential Character.—Calyx tubular, inferior, with an imbricated æstivation. *Stamens* definite, inserted in the tube or its orifice, often 8, sometimes 4, less frequently 2; *anthers* 2-celled, dehiscing lengthwise in the middle. *Ovary* with one solitary pendulous ovule; *style* 1; *stigma* undivided. *Fruit* hard, dry, and nut-like, or drupaceous.—*Stem* shrubby, with tenacious bark. *Leaves* without stipules, alternate or opposite, entire. *Flowers* terminal or axillary, occasionally solitary.

DAPHNE.

Calyx 4-lobed. Stamens 8. Style short, terminal. Berry with 1 cell, and 1 seed.

1. D. *Mezereum*. Flowers naked on the stem, sessile, about 3 together. Leaves lanceolate, deciduous.———*Gardens.* Flowers red or white.

2. D. *pontica* (*Long-flowered Spurge Laurel*). Clusters axillary, simple, drooping, shorter than the smooth, oblong-lanceolate, evergreen leaves. Tube of calyx slender; segments linear-lanceolate.———*Gardens.* Flowers green and sweet-scented.

Fig. CLXXXIX.

Fig. CLXXXIX.—Daphne pontica.

ORDER LV. EUPHORBIACEÆ—SPURGEWORTS.

ESSENTIAL CHARACTER.—*Flowers* monœcious or diœcious. *Calyx* none, or lobed, inferior, with various glandular or scaly internal appendages. *Males: Stamens* definite or indefinite, distinct or monadelphous; *anthers* 2-celled. *Females: Ovary* superior, sessile, or stalked, 3-celled; *ovules* solitary or twin, suspended from the inner angle of the cell; *styles* 3; *stigma* compound, or single. *Fruit* consisting of 3 dehiscent cells, separating with elasticity from their common axis.—*Trees, shrubs*, or *herbaceous* plants, often abounding in acrid milk. *Leaves* opposite or alternate, simple, rarely compound, usually with stipules. *Flowers* axillary or terminal, usually with bracts, sometimes enclosed within an involucre.

*** The fruit of this order is tricoccous; that is, it consists of 3 carpels, which, when ripe, separate from each other with some elasticity, opening by the edge next the axis; this, together with the unisexual flowers, distinctly marks the order.

EUPHORBIA.

Flowers collected in monœcious heads, surrounded by an involucre, consisting of a cup with five divisions, which have externally 5 flat glands alternating with them.

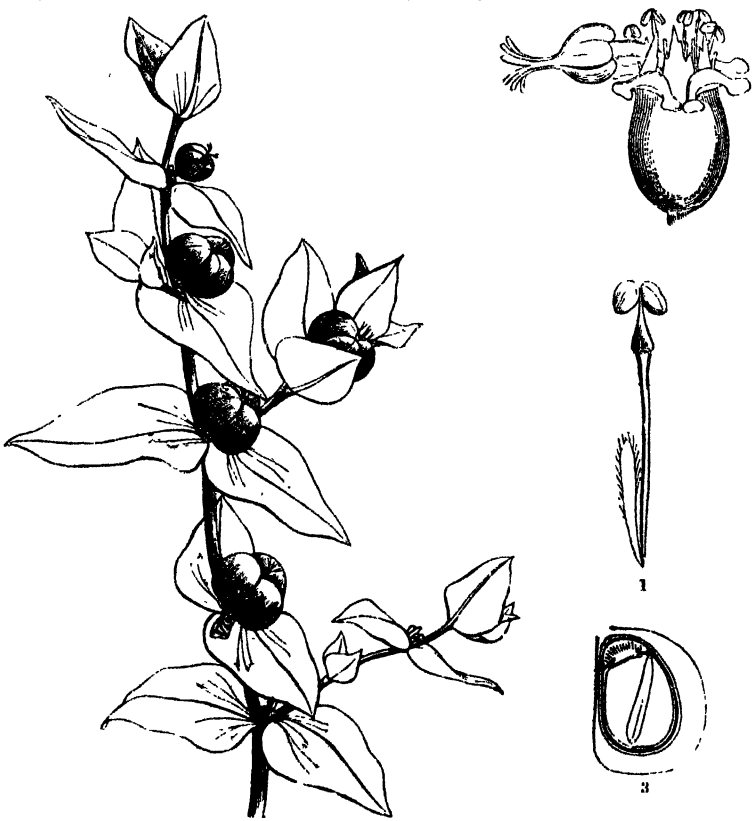

Fig. CXC.

Fig. CXC.—Euphorbia Lathyris; 1. a ♂ flower, and bract; 2. an involucre; 3. a perpendicular section of a seed

♂ Naked, monandrous, articulated with their pedicel, surrounding the female, which is in the centre. — ♀. Naked, solitary. Ovarium stalked. Stigmas 3, forked. Fruit hanging out of the involucre, consisting of 3 cells, bursting at the back with elasticity, and each containing 1 suspended seed.

1. E. *Helioscopia*. Annual. Leaves membranous, obovate-cuneate, obtuse, or emarginate, serrated towards the points, smooth, or occasionally with a few hairs. Whorl 5-cleft, rarely 4- or 3-cleft. Ovaries convex at the back, polished, smooth. Seeds obovate, sculptured, brown, not shining. ——— *Waste places, everywhere.*

2. E. *Lathyris*. Biennial. Leaves somewhat coriaceous, linear, sessile, rather acute, or obtuse, mucronate, entire, smooth. Whorl 4-cleft, rarely bifid, still more rarely 5-cleft Glands lunate, 2-horned; the horns dilated and obtuse. Ovaries convex at the back, with a deep longitudinal furrow, even, smooth. Seeds obovate, truncate at the base, rough, brown, not shining. ——— *Gardens.* The seeds are very purgative, and were so employed. The plant is usually called "Caper" in cottage gardens, but it has nothing in common with the Caperbush (p. 49).

3. E. *Peplus*. Leaves membranous, roundish, tapering into the petiole, very blunt, entire, smooth. Whorl trifid, very seldom 5-fid. Glands lunate, with very long horns. Ovaries with a double-winged keel at the back, wrinkled and scabrous, smooth. Seeds obovate-cylindrical; 4 of the sides dotted in rows, 2 with a longitudinal furrow: greyish-white, not shining. ——— *Waste places.*

BUXUS.

Monœcious. Calyx 3- or 4-parted.—*Male.* Scale 2-lobed. Stamens 4, inserted about the rudiment of an ovarium.—*Female.* Scales 3, very small. Styles 3. Stigmas 3, obtuse. Fruit with 3 horns, 3 cells, and 6 seeds.

1. B. *sempervirens* (*Common Box*). Leaves ovate, convex. Footstalks slightly downy at the edges. Anthers ovate-arrow-shaped.— ——*Chalky hills.* This is the tree whose hard timber is used by the engravers on wood.

Fig. CXC. *b*.

MERCURIALIS.

Dicœcious, or occasionally monœcious. Calyx 3-parted. — *Males.* Stamens 9 to 12. — *Females.* Ovarium double, with two opposite furrows, and two sterile filaments proceeding from each furrow. Styles 2, forked. Fruit dry, consisting of 2 cells bursting with elasticity, and containing each 1 seed.

1. M. *perennis* (*Herb Mercury*). Stem perfectly simple. Leaves rough. Root creeping. ——— *Woods and dry ditches.*

ORDER LVI. URTICACEÆ—NETTLEWORTS.

ESSENTIAL CHARACTER.—*Flowers* monœcious or dicœcious. *Calyx* membranous, lobed, persistent. *Stamens* definite, distinct, inserted into the base of the calyx, and opposite its lobes; *anthers* turned backwards with elasticity when bursting. *Ovary* superior, simple; *ovule* solitary, erect, or suspended; *stigma* simple. *Fruit* a simple indehiscent nut, surrounded by the membranous or fleshy calyx; or a fleshy receptacle, either covered by numerous nuts, lying among the persistent fleshy calyxes, or enclosing them within its cavity.—*Trees*, *shrubs*, or *herbs*, sometimes milky. *Leaves* alternate, usually covered either with asperities or stinging hairs, with membranous *stipules*, which are deciduous or convolute in vernation.

*** The unisexual flowers, simple lenticular fruit, superior radicle, and stipules, afford the essential characteristics of this order, which cannot well be mistaken for any except Chenopodiaceæ, and the plants of that order never have stipules, or rough, or stinging leaves.

Fig. CXC. *b*.—Buxus sempervirens

URTICA.

Monœcious, seldom dicœcious. — *Males* in loose racemes. Calyx 4-parted. Stamens 4. — *Females* in capitate racemes. Calyx 2-leaved. Ovarium 1. Stigma 1. Fruit 1-seeded, enclosed in the calyx.

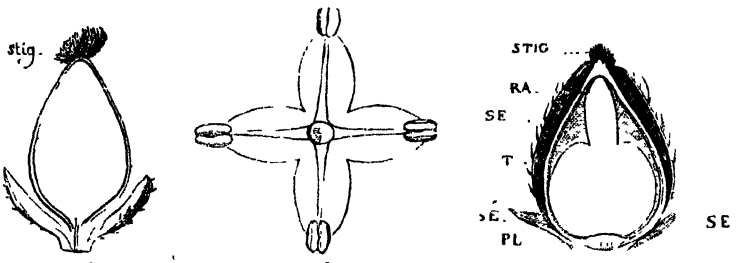

Fig. CXCI.

1. U. *urens* (*Smaller Stinging Nettle*). Leaves opposite, elliptical, with about 5 longitudinal ribs. Clusters nearly simple. ——— *Waste places*

2. U. *dioica* (*Larger Stinging Nettle*). Leaves opposite, heart-shaped. Clusters much branched, in pairs, mostly dicœcious. Roots creeping. ——— *Waste places.*

3. U. *pilulifera* (*Roman Nettle*). Leaves opposite, ovate, serrated; with transverse ribs. Fertile flowers in globular heads. —— — *Gardens.*

CANNABIS.

Flowers dicœcious.—*Male.* Calyx 5-parted. Stamens 5.—*Female.* Calyx 1-leaved, slit on one side. Styles 2. Achœnium lenticular, enclosed in the permanent calyx.

1. C. *sativa* (*Hemp*). A tall annual. Leaves digitate, serrated. ——— *Fields.* This is the plant from which cordage, ropes, and the coarse kinds of linen are manufactured.

HUMULUS.

Dicœcious.—*Males.* Calyx 5-parted. Stamens 5.—*Females* in a lax membranous cone. Ovarium 1. Styles 2. Fruit 1-seeded. Embryo spiral.

1. H. *Lupulus* (*The Hop*). Stems climbing. Leaves stalked, scabrous, cordate, serrated, simple or 3-lobed. —— ——*Hedges.*

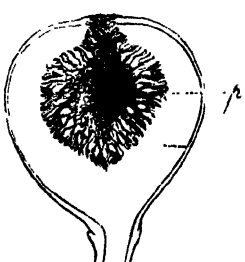

Fig. CXCII.

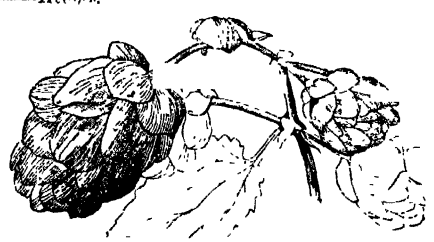

Fig. CXCII. *b.*

1. F. *Carica* (*The Common Fig*). Leaves cordate, palmate, scabrous above, downy on the underside. ——*Gardens.*

FICUS.

Flowers enclosed within fleshy heads, which have a scaly orifice. This produces the figs of the shops.

MORUS.

Stamens 4. — *Females.* Ovary 2-celled.

nt and

e, *p*, inner su
lus Lupulus

1. M. *nigra* (*The Mulberry Tree*). Leaves cordate, ovate, entire or lobed, serrated. Female catkins somewhat sessile, much longer than the peduncle. Calyx smooth at the edge. ———*Gardens.* Fruit deep purple.

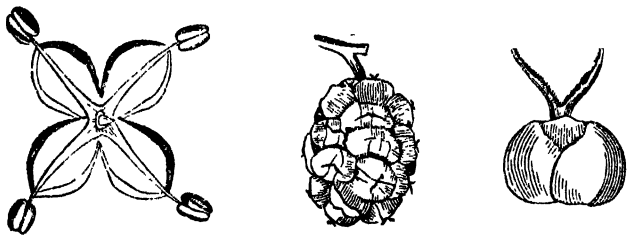

Fig. CXCIII.

ORDER LVII. CORYLACEÆ—MASTWORTS.

ESSENTIAL CHARACTER.—*Flowers* unisexual; males amentaceous, females aggregate or amentaceous. *Males: Stamens* 5 to 20, inserted into the base of the scales, or of a membranous calyx, generally distinct. *Females: Ovaries* crowned by the rudiments of a superior calyx, seated within a coriaceous involucre (*cupule*) of various figure, and with several cells and several ovules, the greater part of which are abortive; *ovules* twin or solitary, pendulous; *stigmas* several, sub-sessile, distinct. *Fruit* a bony or coriaceous 1-celled nut, more or less enclosed in the involucre.—*Trees* or *shrubs*. *Leaves* with stipules, alternate, simple, often with veins proceeding straight from the midrib to the margin.

*** The distinctive organ of this order is the cupule, which, in common language, is called *husk* in the Filbert, Chesnut, and Beech, and *cup* in the Oak.

CASTANEA.

Monœcious. — *Male.* Catkins very long, with irregular clusters of flowers. Stamens from 5 to 20.— *Female.* Cupule generally 3-flowered, 4-lobed, spiny. Stamens 12, abortive. Ovarium 6-celled, with 2 ovules in each cell. Styles 6. Nut 1-celled with from 1 to 3 seeds.

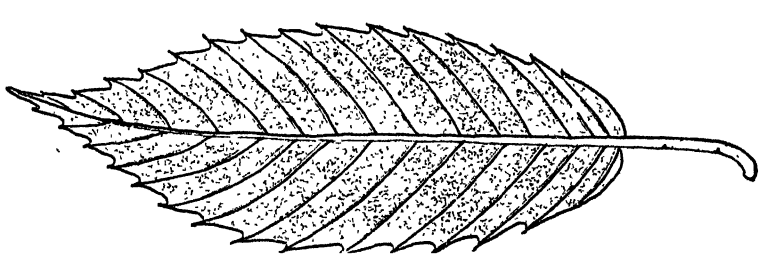

Fig. CXCIV.

1. C. *vesca*. (*The Sweet Chestnut Tree*). Leaves oblong-lanceolate, acuminate, with mucronate serratures, smooth on each side. Cupules large, spiny. ———*Plantations.* A large tree.

Fig. CXCIII. Morus nigra. 1. A male flower; 2. a cluster of females; 3. a female separate
Fig. CXCIV.—Leaf of Castanea vesca.

FAGUS.

Monœcious. — *Males.* Catkins pendulous, globose, dense. Calyx 6-lobed. Stamens 8. —*Females* 2, enclosed in a spiny 4-lobed cupule. Stigmas 3. Ovarium 3-cornered, 3-celled. Nut by abortion 1-celled, 1- or 2-seeded.

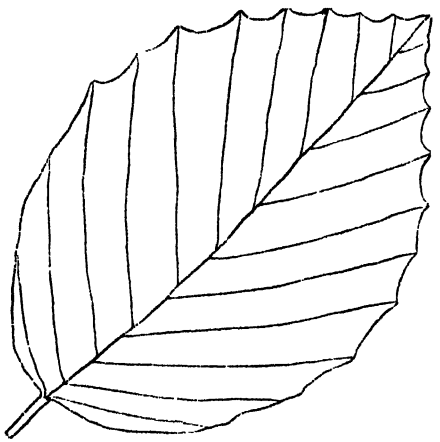

Fig CXCV

1. F. *sylvatica* (*The Beech Tree*). Leaves ovate, shining, thin, obsoletely serrated. Prickles of the cupule simple. Stigmas 3. — *Woods.* A large tree with a smooth bark. Its triangular nuts, or mast, are greedily devoured by pigs and wild animals. Its timber is hard, brittle, and not durable unless kept under water. It is used for the planking of ships and for making chairs, but is quickly attacked by insects.

QUERCUS.

Monœcious. — *Male.* Catkin lax and pendulous. Stamens from 5 to 10. — *Female.* Cupule cup-shaped, covered with scales. Ovarium with three cells, 2 of which are abortive. Stigmas 3. Acorn 1-celled, 1-seeded, seated in the cup-shaped cupule.

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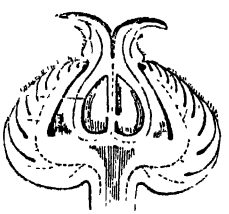

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Fig CXCVI.

1. Q. *Ilex* (*Evergreen Oak*). Leaves evergreen, ovate or lanceolate, mucronate, entire or serrated, shining above, hoary beneath. Bark even. —— *Plantations*

2. Q. *sessiliflora*. Leaves on long stalks, deciduous, oblong, with opposite acute sinuses. Fruit sessile —— *Woods.*

3 Q. *Cerris* (*Turkey Oak*). Leaves deciduous, obovate, sinuate or pinnatifid,

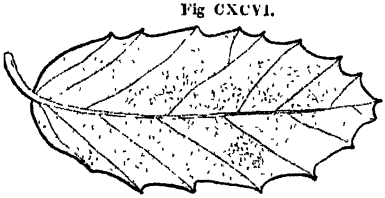


Fig CXCVII.

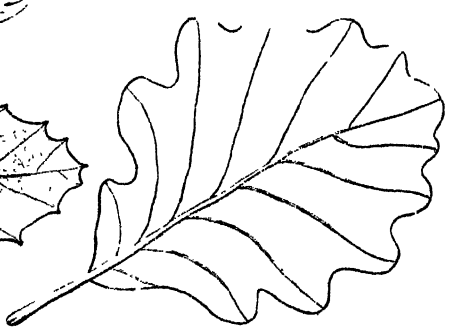


Fig CXCVIII

V.—Beech. Fig. CXCVI.—Quercus pedunculata. 1, ♂ flower; 2. ♀ ditto; 3. transverse section of the ovary, 4. perpendicular section of the ♀ showing young cupule and ovules.

Fig. CXCVII.—Quercus Suber. Fig. CXCVIII.—Quercus sessiliflora

downy, with mucronated lobes. Cup of the acorn with long spreading narrow bracts. ——*Plantations.*

Fig. CXCIX.

4. Q. *pedunculata* (*Common Oak*). Leaves sessile, deciduous, oblong, wider towards the extremity; their sinuses rather acute, lobes obtuse. Fruit-stalks long.——*Woods.*

5. Q. *Suber* (*Cork Oak*). Leaves evergreen, ovate or lanceolate, mucronate, entire or serrated, hoary beneath. Bark corky, split into deep fissures. —— *Plantations.* This is the plant whose bark is brought from the cork forests of Spain and converted into the stoppers of bottles and other vessels.

N. B.—British Oak is obtained from Q. pedunculata and sessiliflora; their timber is of equally good quality, though different; the latter is what is called chesnut in old buildings.

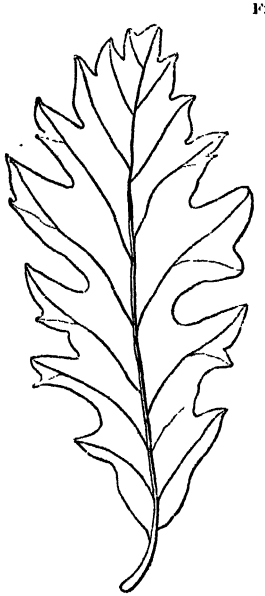


Fig. CC.

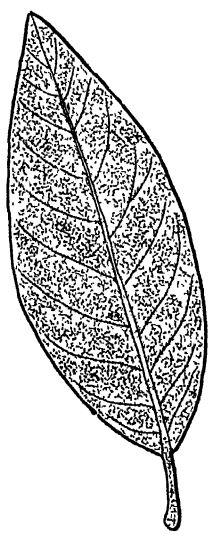


Fig. CCI.

CORYLUS.

Monœcious.—*Male.* Catkins cylindrical, with 3-lobed bracts, the middle lobe of which covers the 2 lateral

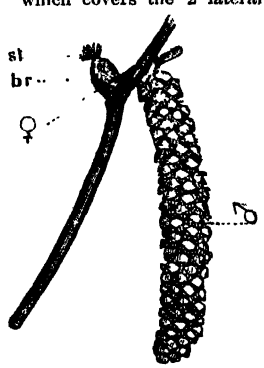


Fig. CCII.

ones. Stamens 8. Anthers 1-celled.—*Female.* Flowers numerous, enclosed in a scaly bud. Stigmas 2. Nut enclosed in a lacerated cupule.

Fig. CXCIX.—Quercus pedunculata. Fig. CC.—Quercus Cerris. Fig. CCI.—Quercus Ilex.
Fig. CCII.—Flowers of Corylus Avellana. ♀ female bud; *st.* styles; *br.* bracts; ♂ male catkin.

FAGUS.

Monœcious. — *Males.* Catkins pendulous, globose, dense. Calyx 6-lobed. Stamens 8. —*Females* 2, enclosed in a spiny 4-lobed cupule. Stigmas 3. Ovarium 3-cornered, 3-celled. Nut by abortion 1-celled, 1- or 2-seeded.

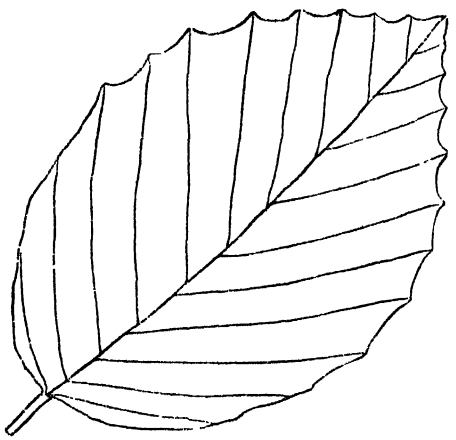
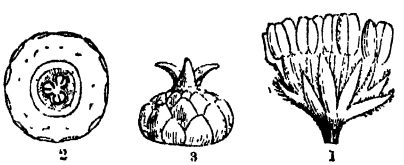


Fig. CXCV

1. F. *sylvatica* (*The Beech Tree*). Leaves ovate, shining, thin, obsoletely serrated. Prickles of the cupule simple. Stigmas 3. — *Woods.* A large tree with a smooth bark. Its triangular nuts, or mast, are greedily devoured by pigs and wild animals. Its timber is hard, brittle, and not durable unless kept under water. It is used for the planking of ships and for making chairs, but is quickly attacked by insects.

QUERCUS.

8. — *Male.* Catkin lax and pendulous. Stamens from 5 to 10. — *Female* Cupule cup-shaped, covered with scales. Ovarium with three cells, 2 of which are abortive. Stigmas 3. Acorn 1-celled, 1-seeded, seated in the cup-shaped cupule.



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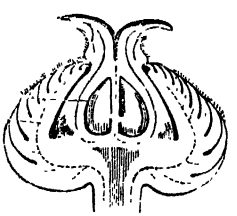

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Fig. CXCVI.

1. Q. *Ilex* (*Evergreen Oak*). Leaves evergreen, ovate or lanceolate, mucronate, entire or serrated, shining above, hoary beneath. Bark even. ——— *Plantations.*

2. Q. *sessiliflora* Leaves on long stalks, deciduous, oblong, with opposite acute sinuses. Fruit sessile ——— *Woods.*

3 Q. *Cerris* (*Turkey Oak*). Leaves deciduous, obovate, sinuate or pinnatifid,

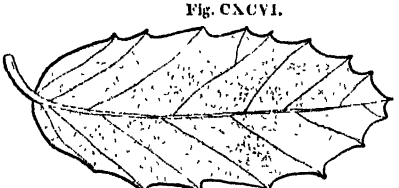


Fig. CXCVII.

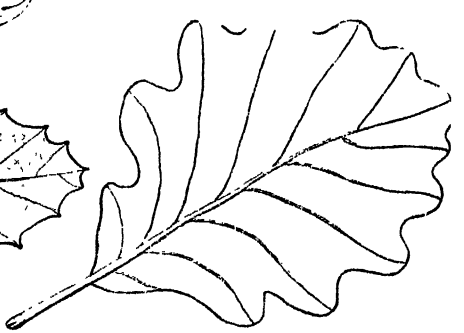


Fig. CXCVIII

Fig CXCV.—Beech. Fig. CXCVI.—Quercus pedunculata. 1, 2 flower; 2. ♀ ditto; 3. transverse section of the ovary, 4. perpendicular section of the ♀ showing young cupule and ovules.

Fig. CXCVII.—Quercus Suber. Fig. CXCVIII.—Quercus sessiliflora

downy, with mucronated lobes. Cup of the acorn with long spreading narrow bracts. ———*Plantations.*

Fig. CXCIX.

4. Q. *pedunculata* (*Common Oak*). Leaves sessile, deciduous, oblong, wider towards the extremity; their sinuses rather acute, lobes obtuse. Fruit-stalks long.——— *Woods.*

5. Q. *Suber* (*Cork Oak*). Leaves evergreen, ovate or lanceolate, mucronate, entire or serrated, hoary beneath. Bark corky, split into deep fissures. ——— *Plantations.* This is the plant whose bark is brought from the cork forests of Spain and converted into the stoppers of bottles and other vessels.

N. B.—British Oak is obtained from Q. pedunculata and sessiliflora; their timber is of equally good quality, though different; the latter is what is called chesnut in old buildings.

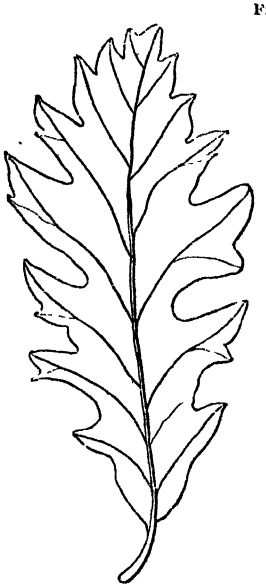


Fig. CC.

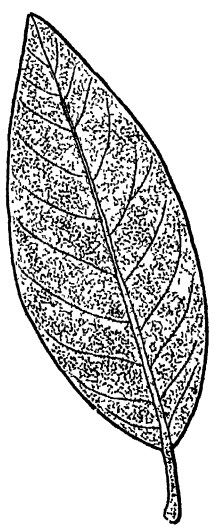


Fig. CCI.

CORYLUS.

Monœcious.—*Male.* Catkins cylindrical, with 3-lobed bracts, the middle lobe of which covers the 2 lateral ones. Stamens 8. Anthers 1-celled.—*Female.* Flowers numerous, enclosed in a scaly bud. Stigmas 2. Nut enclosed in a lacerated cupule.

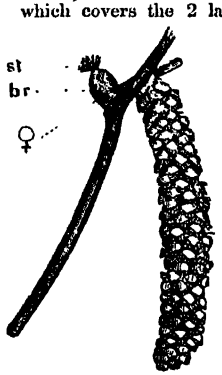


Fig. CCII.

Fig. CXCIX.—Quercus pedunculata. Fig. CC.—Quercus Cerris. Fig. CCI.—Quercus Ilex. Fig. CCII.—Flowers of Corylus Avellana. ♀ female bud; *st.* styles; *br.* bracts; ♂ male catkin.

1. P. *nigra* (*Black Poplar*). Leaves rhomboidal, pointed, serrated ; smooth on both sides. Catkins all lax and cylindrical. Stigmas 4, simple, spreading. ——*Woods.*

2. P. *alba* (*The Abele Tree*). Leaves lobed and toothed ; somewhat heart-shaped at the base, snow-white and densely downy beneath. Fertile catkins ovate. Stigmas 4. ——*Woods*

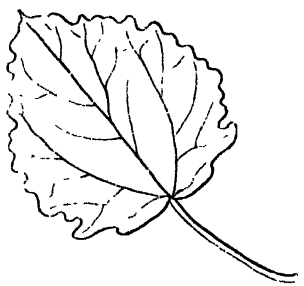


Fig. CCX.

3. P. *canescens* (*The White Poplar*). Leaves roundish, deeply waved, toothed ; hoary and downy beneath. Fertile catkins cylindrical. Stigmas 8. —— *Woods.*

4. P. *fastigiata* (*The Lombardy Poplar*). Branches very erect, forming a long cylindrical head. Leaves somewhat rhomboid, unequally serrated, smooth. ——*Plantations.*

5. P. *tremula* (*The Aspen Tree*). Leaves nearly orbicular, toothed, smooth on both sides. Footstalks compressed. Young branches hairy. Stigmas 4, erect, auricled at the base.——*Woods.*

N. B.—The timber of all these trees is soft, and of little value.

ORDER LIX. BETULACEÆ—BIRCHWORTS.

ESSENTIAL CHARACTER.—*Flowers* unisexual, monœcious, amentaceous ; the males sometimes having a membranous lobed calyx. *Stamens* distinct, scarcely ever monadelphous ; *anthers* 2-celled. *Ovary* superior, 2-celled ; *ovules* definite, pendulous ; *style* single or none ; *stigmas* 2. *Fruit* membranous, indehiscent, by abortion 1-celled. *Seeds* pendulous, hairless.—*Trees* or *shrubs*. *Leaves* alternate, simple, with the primary veins often running straight from the midrib to the margin ; *stipules* deciduous.

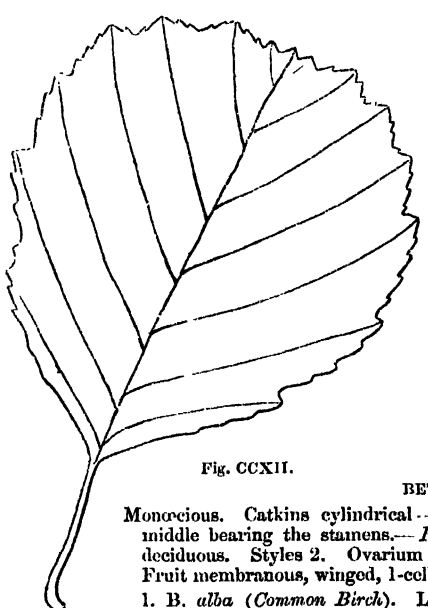


Fig. CCXII.

Fig. CCXI.

BETULA.

Monœcious. Catkins cylindrical.—*Males.* Bracts ternate, that in the middle bearing the stamens.—*Female.* Bracts 3-lobed, membranous, deciduous. Styles 2. Ovarium compressed, 2-celled ; 1 cell abortive. Fruit membranous, winged, 1-celled.

1. B. *alba* (*Common Birch*). Leaves ovate, acute, somewhat deltoid, unequally serrated, nearly smooth. Branches erect ; when young, pubescent.——*Woods.* A tree.

Fig. CCX.—Populus tremula. Fig. CCXI.—♂ and ♀ catkins of Betula alba.
Fig. CCXII.—Alnus glutinosa.

ALNUS.

Monœcious.—*Male.* Catkins cylindrical. Bracts stalked, cordate, with 3 smaller beneath them, which are staminiferous at the base.—*Female.* Catkins roundish-ovate. Bracts 2-flowered, coriaceous, persistent. Ovarium compressed. Stigmas 2. Fruit compressed, ovate, 2-celled, 2-seeded.

1. A. *glutinosa* (*Common Alder*). Leaves roundish-wedge-shaped, wavy, serrated, glutinous, rather abrupt; downy at the branching of the veins beneath.———*Marshes and sides of streams.* A small tree.

ORDER LX. ULMACEÆ—ELMWORTS.

Essential Character.—*Flowers* hermaphrodite or polygamous, never in catkins. *Calyx* divided, campanulate, inferior, irregular. *Stamens* definite, inserted into the base of the calyx; erect in æstivation. *Ovary* superior, 2-celled; *ovules* solitary, pendulous; *stigmas* 2, distinct. *Fruit* 1- or 2-celled, indehiscent, membranous or drupaceous. *Seed* solitary, pendulous.—*Trees* or *shrubs*, with scabrous, alternate, simple, deciduous leaves, and stipules.

Calyx campanulate, 4- or 5-toothed, persistent. Stamens from 3 to 6. Ovarium compressed. Stigmas 2, sessile. Pericarp membranous, winged, compressed, 1-seeded.

1. U *campestris* (*Common Elm*). Leaves rhomboid-ovate, acuminate, wedge-shaped, and oblique at the base, always scabrous above, doubly and irregularly serrated, downy beneath, serratures incurved. Branches wiry, slightly corky; when young bright brown, pubescent. Fruit oblong, deeply cloven, naked.———*Woods.*

U. *montana* (*Witch Elm*). Leaves obovate, cuspidate, doubly and coarsely serrate, cuneate and nearly equal at the base, always exceedingly scabrous above, evenly downy beneath. Branches not corky, cinereous, smooth. Fruit rhomboid-oblong, deeply cloven, naked.———*Woods.*

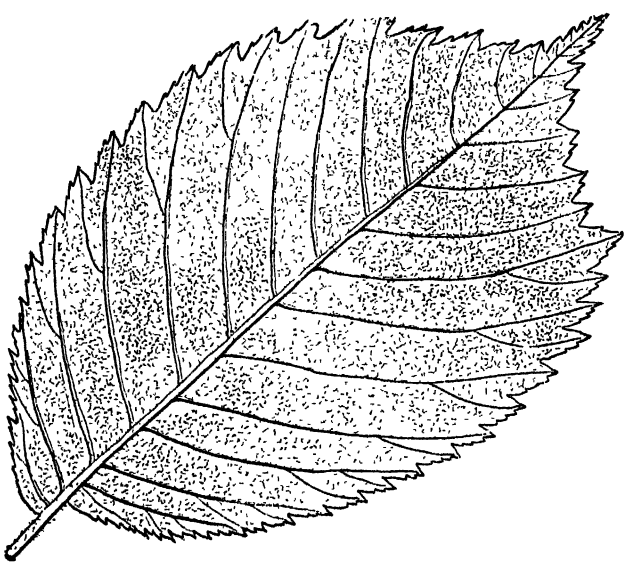


Fig. CCXIII.

Fig. CCXIII.—Ulmus montana.

3. U. *glabra*. Leaves ovate-lanceolate, acuminate, doubly and evenly crenato-ser-

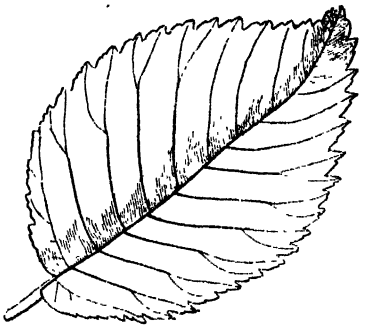


Fig. CCXIV.

rate, cuneate and oblique at the base, becoming quite smooth above, smooth or glandular beneath, with a few hairs in the axils of the veins. Branches bright brown, smooth, wiry, weeping. Fruit obovate, naked, slightly cloven. ——— *Woods*.

N.B. Elm wood is tough, but coarse, and only fit for rough purposes, such as cart-making, coffin boards, and water pipes. It is durable if constantly immersed in water or damp earth.

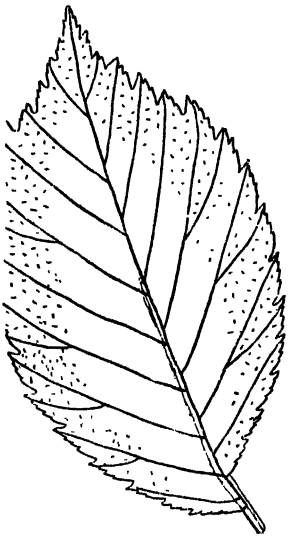


Fig. CCXV.

ORDER LXI. PINACEÆ—CONIFERS

ESSENTIAL CHARACTER.—*Flowers* monœcious or diœcious. *Males* monandrous or monadelphous; each floret consisting of a single *stamen*, or of a few united, collected, in a deciduous amentum, about a common rachis. *Females* in cones or a cup. *Ovary* open, destitute of style or stigma. *Ovules* naked. *Fruit* consisting of a cone formed of the scale-shaped ovaries, become enlarged and indurated, and occasionally of the bracts also; or a fleshy cup. *Seed* with a hard crustaceous integument.—*Trees* or *shrubs*, with a branched trunk usually abounding in resin. *Wood* with the ligneous tissue marked with circular disks. *Leaves* linear, acerose, or lanceolate, entire at the margins.

TAXUS.

Flowers diœcious or monœcious, surrounded by scales.—*Males*. Stamens 8 or 10, monadelphous.—*Females*. Nut enclosed in a succulent cup.

1. T. *baccata* (*The Yew Tree*). Leaves linear, distichous. Fruit roundish, bright red. ——— *Plantations and rocky woods*.

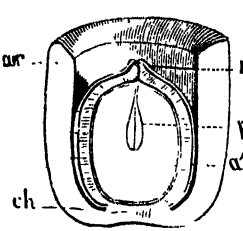


Fig. CCXVI.

JUNIPERUS.

Diœcious or monœcious.—*Males*. Catkins ovate, with 4-6 1-celled anthers.—*Females*. Cone round, consisting of 3 fleshy scales growing together, and enclosing 3 bony nuts.

1. J. *communis* (*Juniper bush*). Leaves 3 in each whorl, tipped with a spine, spreading, longer than the ripe fruit. ——— *Heathy downs*.

Fig. CCXIV.—Ulmus glabra.

Fig. CCXV.—Ulmus campestris.

Fig. CCXVI.—Fruit of the Yew, divided perpendicularly. *alb.* albumen; *ch.* chalaza; *mi.* micropyle or foramen.

ar. The succulent cup; *pl.* embryo;

PINUS.

Monœcious.—*Males.* Catkins with the scales each bearing 2 1-celled anthers at the ends. —*Females.* Catkins with acuminate scales. Ovaries 2. Cones with oblong clavate woody scales, with an angular termination.—Leaves 2 or more from the same sheath.

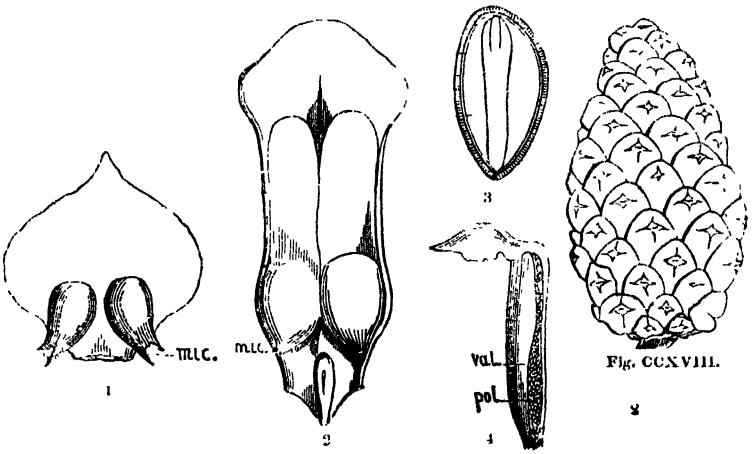


Fig. CCXVII.

Fig. CCXVIII.

Fig. CCXIX.

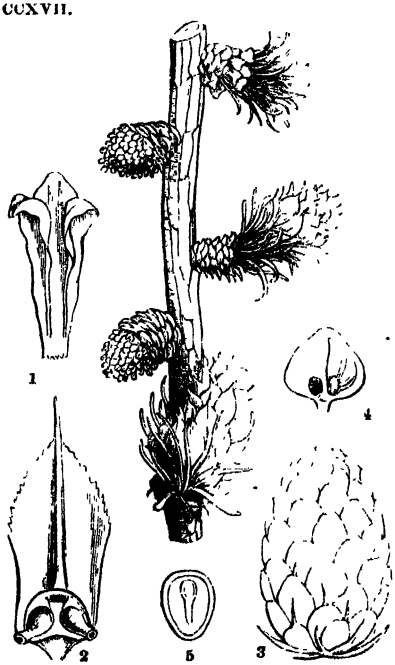


Fig. CCXX.

Fig. CCXVII.—1. Female scale of Pinus sylvestris, with a pair of ovules; *mic.* the opening into the ovule; 2 ripe scale and seeds; 3. a longitudinal section of a seed; 4. anther: *pol.* pollen, *val.* valve.
Fig. CCXVIII.—Cone of the same. Fig. CCXIX.—Abies excelsa.
Fig. CCXX.—Abies Larix. 1. An anther, 2. a female scale with ovules; 3. a ripe cone; 4. a scale of the latter with a naked seed; 5. vertical section of seed and embryo.

1. P. *sylvestris* (*Scotch Fir*). Leaves rigid, in pairs, glaucous. Young cones stalked, recurved. Crest of the anthers very small. ——— *Woods.*
2. P. *Pinaster* (*Cluster Pine*). Leaves in pairs, very long, stiff, and dark green. Cones large, sessile, clustered, recurved. ——— *Plantations.*

ABIES.

Scales of the cones flattened at the end, equal, not umbonate.—Leaves single.

1. A. *excelsa* (*The Spruce Fir*). Leaves evergreen, compressed, somewhat 4-cornered, mucronate, solitary. Cones cylindrical, pendulous. ——— *Plantations.*

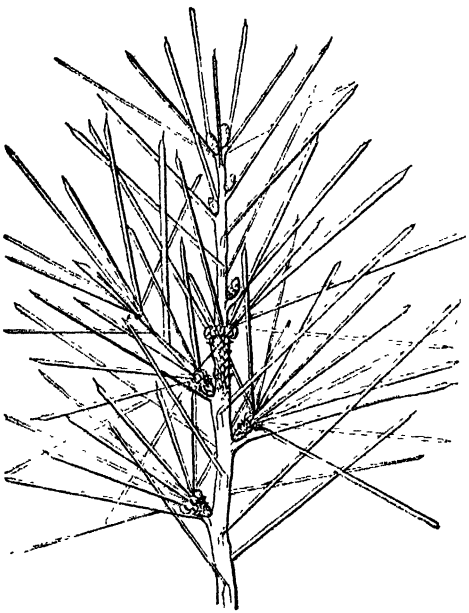


Fig. CCXXI.

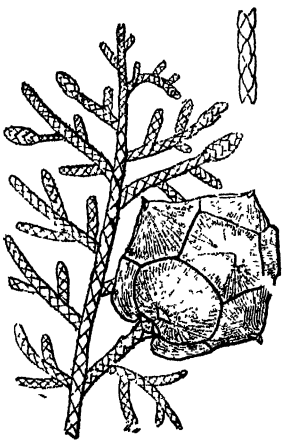


Fig. CCXXII.

2. A. *Larix* (*The Larch*). Leaves deciduous, fascicled. Cones lax, ovate, erect. — *Woods and plantations.*
3. A. *Cedrus* (*The Cedar of Lebanon*). Leaves evergreen, fascicled. Cones roundish, woody, very compact, erect. ——— *Gardens.*

CUPRESSUS.

Flowers monœcious. Anthers 4, 1-celled, inserted on the lower side of a peltate scale. Cone dry, composed of woody peltate scales, with a projecting point in the middle.

1. C. *sempervirens* (*The Cypress Tree*). Branches erect; twigs quadrangular. Leaves imbricated in 4 rows, obtuse, appressed, convex. Cones subglobose. ——— *Gardens.*

The following natural orders of this subclass also belong to the Flora of Europe, but are of less importance than the preceding:

LAURACEÆ—LAURELS.

ESSENTIAL CHARACTER.—*Calyx* imbricated. *Stamens* opposite the segments of the calyx, the 3 innermost sterile or deficient; *anthers* bursting by

Fig. CCXXI.—Abies Cedrus. Fig. CCXXII.—Cupressus sempervirens.

a valve from the base to the apex. *Glands* usually present at the base of the inner filaments. *Ovary* single, superior, with 1 or 2 single pendulous ovules; *style* simple; *stigma* obtuse. *Fruit* baccate or drupaceous.—*Trees* often of great size. *Leaves* without stipules, alternate, aromatic.

*** The only European plant is *Laurus nobilis*, the *Sweet Bay*, a shrub common in gardens. Like Berberidaceæ, this order has anthers opening by recurved valves, but there are no petals, and the leaves are aromatic.

ARISTOLOCHIACEÆ—BIRTHWORTS.

Essential Character.—*Flowers* hermaphrodite. *Calyx* superior, tubular with 3 segments, which are valvate, regular, or very irregular. *Stamens* 6 to 10, epigynous. *Ovary* inferior, 3 or 6-celled; *ovules* numerous, horizontally attached to the axis; *style* simple, *stigmas* radiating, as numerous as the cells of the ovary. *Fruit* dry or succulent, 3- or 6-celled, many-seeded.—*Herbaceous* plants or *shrubs*, the latter often climbing. *Leaves* alternate, simple, stalked, often with leafy stipules. *Flowers* axillary, solitary, brown or some dull colour.

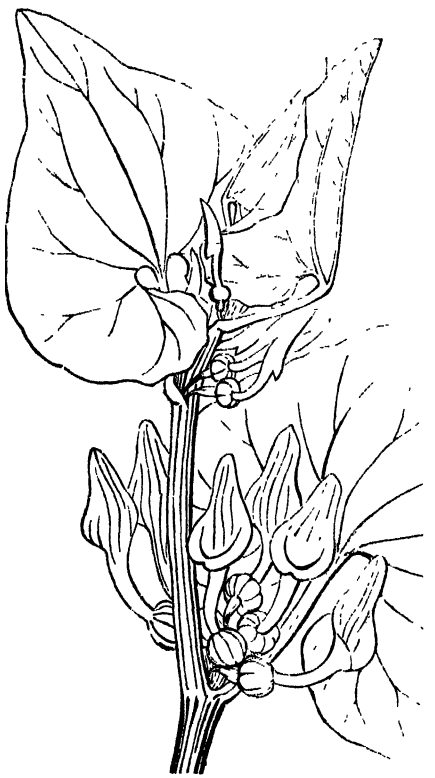


Fig. CCXXIII.

*** *Asarum europæum*, a dwarf herbaceous plant with dingy brown flowers hidden beneath the leaves, and a few species of *Aristolochia*, make up the European part of this order, which resembles no other monochlamydeous Exogens in appearance, and which is readily known by its flowers being ☿ and the ovary inferior and many-seeded. *Aristolochia Clematitis*, an upright plant with light yellow flowers, is British, and is common in botanic gardens.

MIRICACEÆ—GALEWORTS.

Essential Character.—*Flowers* unisexual, amentaceous, achlamydeous. *Males: Stamens* 6, rarely 8, somewhat monadelphous; *anthers* 2- or 4-celled, opening lengthwise. *Females: Ovary* 1-celled, surrounded by several hypogynous scales; *ovule* solitary, erect; *stigmas* 2, subulate, or dilated. *Fruit* drupaceous, often covered with waxy secretions.—

Fig. CCXXIII.—Aristolochia Clematitis.

Leafy shrubs, with resinous glands and dots, the leaves alternate, simple, with or without stipules.

*** The *Sweet Gale* (*Myrica Gale*), a fragrant shrub found in boggy commons and moors, represents in Europe this exotic order, which is very near Urticaceæ, but has not stipules, and has amentaceous achlamydeous flowers. It differs from Salicaceæ in the seed being solitary and not comose, and from Betulaceæ in the fruit not being 2-celled, but quite simple.

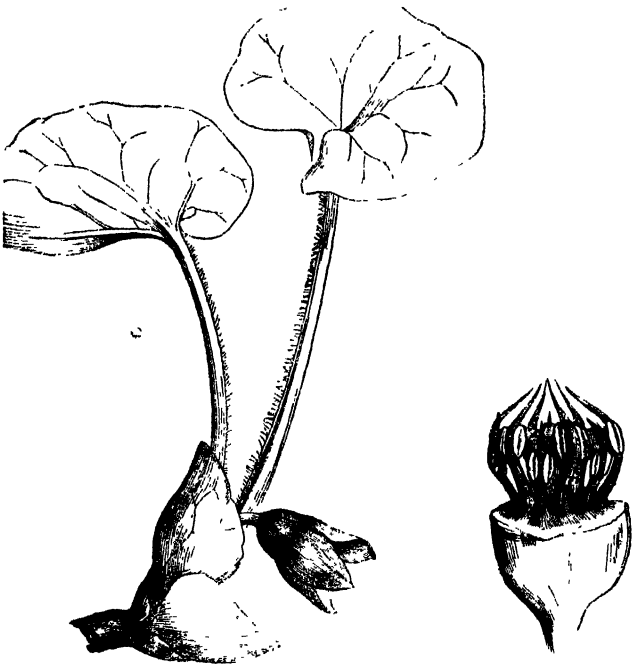


Fig. CCXXIII *b*. *c*

CHAPTER VIII.

OF ENDOGENS.

These plants are not divided by M. De Candolle into subclasses, but are all included in a single group. The principal orders in the Flora of Europe are the following namely :—

Butomaceæ ; Naiadaceæ ; Orchidaceæ ; Iridaceæ ; Amaryllidaceæ ; Liliaceæ ; Melanthaceæ ; Typhaceæ ; Araceæ ; Cyperaceæ ; Graminaceæ.

They may be briefly distinguished as follo

Alismaceæ.—Flowers tripetaloid ;* unisexual or bisexual. Stamens hypogynous. Carpels several, distinct, with 1 or 2 seeds in each.

Butomaceæ.—Flowers in some measure tripetaloid. Stamens hypogynous. Carpels several, distinct, with an indefinite number of ovules adhering to their inner surface.

Naiadaceæ.—Sepals and petals minute, in a power of 2, deciduous, alike. Sta-

* Τρεις, *three*, and πεταλον, *a petal*. This term is employed in Endogens when the 3 sepals are green and in their usual state, the 3 petals alone resembling the parts so called in other flowers. It is used in distinction to hexapetaloid, which indicates those flowers which have the sepals also large and resembling the petals in colour and texture.

Fig. CCXXIII. *b*.—Asarum europæum ; *c*. its ovary and stamens magnified.

mens in a corresponding number. Carpels distinct, 1-seeded, the same number as the stamens, or fewer.

Orchidaceæ. — Flowers hexapetaloid, irregular. Stamen and style consolidated into a central column. Ovary inferior with parietal placentæ.

Iridaceæ. — Flowers hexapetaloid. Stamens 3, with their anthers turned outwards. Carpels 3, united into an inferior 3-celled ovary.

Amaryllidaceæ. — Flowers hexapetaloid. Stamens 6, with their anthers turned inwards. Carpels 3, united into an inferior 3-celled ovary.

Liliaceæ. — Flowers hexapetaloid. Stamens 6, with their anthers turned inwards. Carpels 3, united into a superior 3-celled ovary.

Melanthaceæ. — Flowers hexapetaloid. Stamens 6, with their anthers turned outwards. Carpels 3, superior, many-seeded, with the styles sometimes united.

Typhaceæ. — Flowers unisexual, incomplete.* Anthers wedge-shaped, on long weak filaments. Carpel solitary, superior, 1-seeded.

Araceæ. — Flowers unisexual, naked,† enclosed within a spathe.

Cyperaceæ. — Flowers glumaceous,‡ naked. Stem solid. Sheath of the leaves perfect.

Graminaceæ. — Flowers glumaceous ‡ and paleaceous.§ Stem hollow. Sheath of the leaves slit on one side.

TABULAR VIEW OF THE PRECEDING NATURAL ORDERS.

A. *Ovary inferior.*
- *a.* Stamens 6 . . . *Amaryllidaceæ.*
- *b.* Stamens 3 . . . . *Iridaceæ.*
- *c.* Stamen 1 . . . *Orchidaceæ.*

B. *Ovary superior.*
- *a.* Flowers dimerous ‖ . *Naiadaceæ.*
- *b.* Flowers trimerous, and completely tripetaloid, with 1-seeded carpels *Alismaceæ.*
- *c.* Flowers trimerous and almost tripetaloid, with many-seeded carpels *Butomaceæ.*
- *d.* Flowers trimerous and hexapetaloid.
  - *α.* Anthers turned inwards *Liliaceæ.*
  - *β.* Anthers turned outwards *Melanthaceæ.*
- *e.* Flowers incomplete.
  - *α.* Flowers within a spathe *Araceæ.*
  - *β.* Flowers not within a spathe *Typhaceæ.*
- *f.* Flowers glumaceous, leaves with an undivided sheath . *Cyperaceæ.*
- *g.* Flowers glumaceous, leaves with the sheath split . .

ORDER LXII. ALISMACEÆ—ALISMADS.

ESSENTIAL CHARACTER. — *Sepals* 3, herbaceous. *Petals* 3, regular, much larger than the sepals, and coloured. *Stamens* hypogynous, 6 or many more. *Ovaries* superior, 3-6, or many more, distinct, 1- or 2-seeded; *stigmas* simple. *Carpels* dry, indehiscent. — Water or marsh *plants*.

*** The numerous distinct carpels which are 1- or 2-seeded, give the plants something the appearance of Ranunculaceæ. The order differs from Butomaceæ in its carpels being 1-2-seeded, and from Juncaginaceæ in its petals being petaloid, that is large and coloured, not small and green.

ALISMA.

Flowers hermaphrodite. Sepals 3. Petals 3. Stamens 6. Carpels 6 or more, 1-seeded, indehiscent.

1. A. *Plantago* (*Water Plantain*). Leaves cordate, ovate, or lanceolate. Scape panicled, whorled. Carpels rounded at the point, furrowed at the back. ——— *Ditches.*

* That is, having a part of the organs missing. The term is generally used with reference to the calyx or corolla.

† That is, having no calyx or corolla.

‡ That is, having the appearance of the *gluma*, or husk, of corn.

§ That is, having the *palea*, or chaff, peculiar to corn. See the detailed account of these orders further on.

‖ Δις, *two*, and μερος, *a part*. This is said when the parts of the flower are some power of 2; in like manner *trimerous* means that they are a power of 3; and so on.

SAGITTARIA.

Flowers monœcious. Calyx 3-parted. Petals 3.—*Males.* Stamens numerous.—*Females.* Carpels numerous, seated on a globose receptacle.

1. S. *sagittæfolia* (*Arrow Head*). Leaves deeply arrow-headed. Scape simple. ———*Ditches.* Flowers white.

ORDER LXIII. BUTOMACEÆ—BUTOMADS.

ESSENTIAL CHARACTER.—*Sepals* 3, usually herbaceous. *Petals* 3, coloured, petaloid. *Stamens* definite or indefinite, hypogynous. *Ovaries*

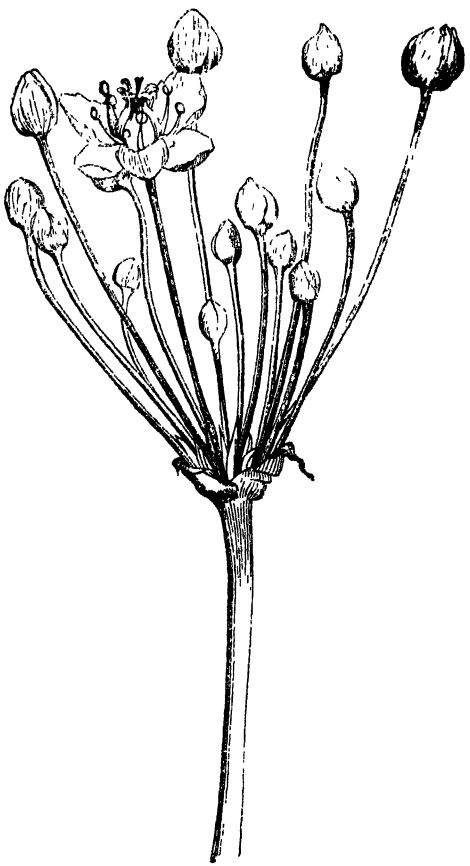


Fig. CCXXIII. *c.*

superior, 3, 6, or more, either distinct or united into a single mass; *stigmas* the same number as the ovaries, simple. *Follicles* many-seeded, either

Fig. CCXXIII. *c.*—Butomus umbellatus.

distinct and rostrate, or united in a single mass. *Seeds* minute, very numerous, attached to the whole of the inner surface of the fruit.—*Aquatic* plants. *Leaves* very cellular, with parallel veins, often yielding a milky juice. *Flowers* in umbels, conspicuous, purple or yellow.

*** These are distinguished from the last by their carpels each containing numerous small seeds.

BUTOMUS.

Sepals and petals equally coloured. Stamens 9, of which 3 are internal and petaloid. Ovaries 6, with long styles. Fruit capsular, dehiscing at the inner edge. Seeds linear-oblong, straight, with longitudinal streaks.

1. B. *umbellatus* (*Flowering Rush*). A plant 2-3 feet high, with narrow sword-shaped leaves and umbels of dull purple flowers.——*Ditches and river sides.*

ORDER LXIV. NAIADACEÆ—NAIADS.

Essential Character.—*Flowers* hermaphrodite or unisexual. *Perianth* of 2 or 4 pieces, often deciduous, rarely wanting. *Stamens* definite, hypogynous. *Ovaries* 1 or more, superior; *stigma* simple; *ovule* solitary; pendulous. *Fruit* dry, not opening, 1-celled, 1-seeded. *Seed* pendulous. —*Water-plants.* *Leaves* very cellular, with parallel veins. *Flowers* inconspicuous, usually arranged in terminal *spikes*.

Sepals 2. Petals 2. Stamens 4, opposite the sepals and petals; anthers nearly sessile. Ovaries 4, alternate with the stamens; ovules solitary, suspended. Nuts 4, compressed. Seed suspended, arcuate, more or less spiral.—Floating plants, with pellucid leaves.

1. P. *natans*. Lower petioles leafless, elongated. Nuts large, keeled at the back.——*Rivers and ditches.*

2. P. *gramineus*. Leaves 3-ribbed, blunt, with a few obsolete veins. Spikes ovate, on short stalks.——*Rivers and ditches.*

ZANNICHELLIA

Flowers solitary, monœcious.—*Males.* Stamen single, naked, placed at the base of the female flower on the outside.—*Female.* Perianthum campanulate. Ovaries 2-6. Fruit dry, 1-seeded, sessile, compressed, gibbous, crenated outwardly.

1. Z. *palustris*. Anther of 4 cells. Stigmas entire.——*Rivers and ditches.*

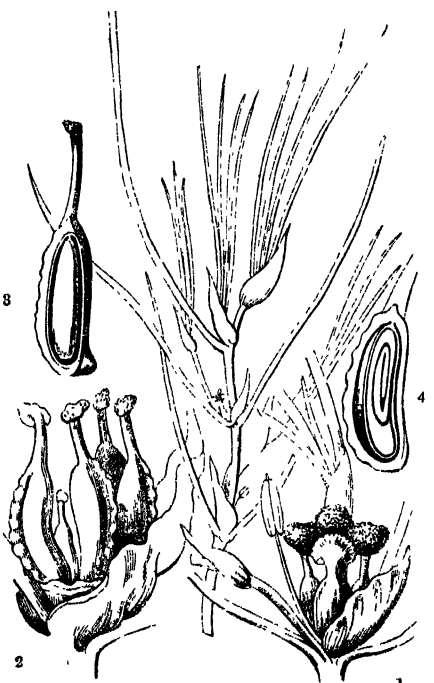


Fig. CCXXIII. *d*.

Fig. CCXXIII. *d*.—Zannichellia palustris. 1. A pair of flowers, one ♂ the other ♀. 2. A ripe pistil, with four perfect carpels and one imperfect. 3. A vertical section of an ovary. 4. Do. of a ripe carpel, showing the seed. All magnified

ORDER LXV. ORCHIDACEÆ—ORCHIDS.

ESSENTIAL CHARACTER.—*Perianth* superior, ringent. *Sepals* 3, coloured. *Petals* 3, coloured, of which 2 are uppermost, and 1, called the *lip*, undermost; this latter is frequently lobed, of a different form from the others,

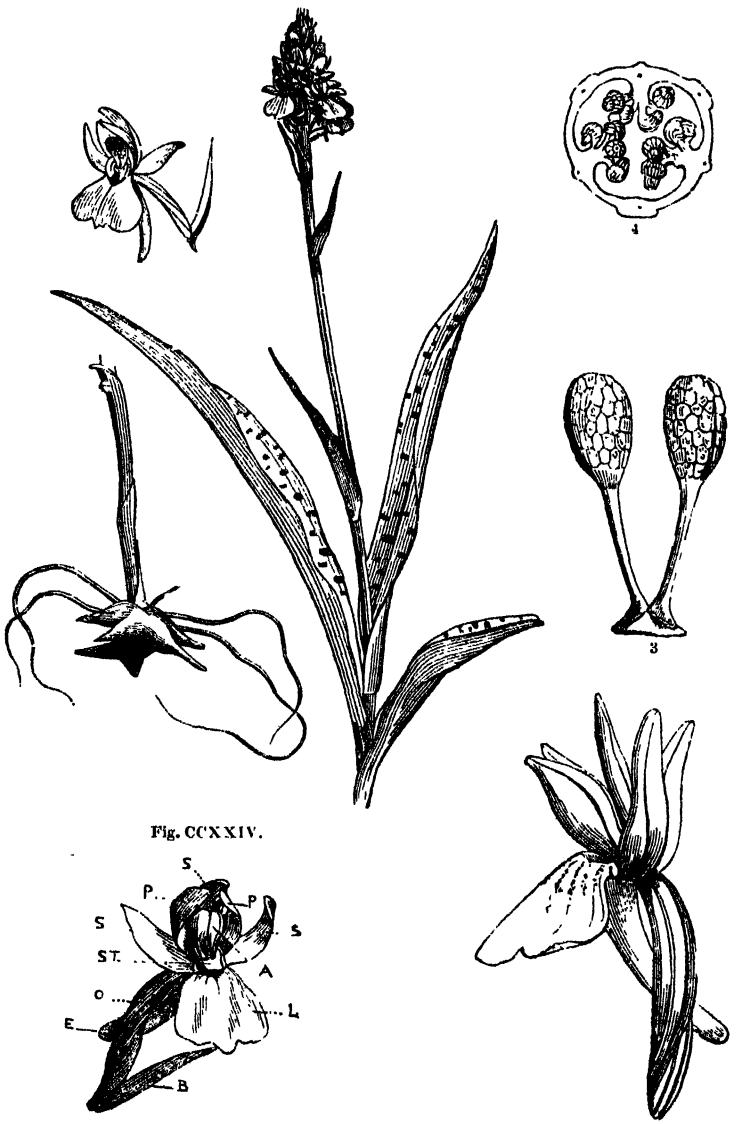


Fig. CCXXIV.

Fig. CCXXIV.—Orchis maculata. 1. Flower, seen in face; *B* bract, *E* spur, *O* ovary, *s* sepals, *p* petals, *l* lip, *a* anther, *st.* stigma, 2. side view of a flower; 3. pollen masses; 4. transverse section of the ovary.

and very often spurred at the base. *Stamens* 1 or 2, united with the style and stigma into one solid column. *Ovary* 1-celled, with three parietal placentæ ; *style* forming part of the column of the stamens ; *stigma* a viscid space in front of the column. *Capsule* inferior, bursting with three valves and 3 ribs. *Seeds* parietal, very numerous. — *Herbaceous* plants. *Roots* fleshy, divided or undivided, or fasciculate. *Leaves* simple, quite entire, often articulated with the stem. *Pubescence* rare; when present, sometimes glandular. *Flowers* in terminal or radical spikes, or racemes.

*** The gynandrous flowers are a certain mark of this order.

ORCHIS.

Sepals and petals ringent, coloured ; lip lobed, spurred at the base. Pollen masses with 2 glands, enclosed in a common pouch.

1. O. *mascula*. Roots oval, undivided. Lip 4-cleft, crenate ; spur obtuse. Sepals 3-ribbed ; two lateral ones reflexed upwards ———*Meadows and pastures.*

2. O. *Morio* (*Fool's Orchis*). Roots undivided, oval. Lip 4-cleft, somewhat crenate ; spur obtuse, ascending. Sepals many-ribbed, converging.———*Meadows and pastures.*

3. O. *maculata*. Roots palmate, spreading. Lip flat, crenate, 3-lobed ; spur cylindrical, rather shorter than the ovary. Bracts shorter than the flowers.———*Meadows and pastures.*

ANACAMPTIS

The structure of Orchis, *except* that a pair of small vertical plates (lamellæ) are found at the base of the lip.

1. A. *pyramidalis*. Leaves very sharp-pointed. Flowers in a close pyramidal spike. Lip with 3 equal entire lobes. Spur subulate.———*Calcareous pastures.* Flowers rose-coloured, or white.

PLATANTHERA.

Sepals spreading or converging, coloured or herbaceous. Petals of the same figure as the sepals, coloured or herbaceous ; lip entire or 3-lobed, with a spur at the base. Column very much compressed. Lobes of the anther diverging, not distinct from the processes of the column. Pollen masses with 2 naked glands.

1. P. *chlorantha* (*Butterfly Orchis*). Lip linear, undivided, with a spur twice as long as the ovary, filiform and clavate. Cells of the anther distant at the base.——— *Woods.*

OPHRYS.

Sepals spreading, coloured or herbaceous. Petals much smaller than the sepals, generally coloured ; lip convex, not spurred, more or less lobed, usually hairy, and figured. Pollen masses with 2 glands, each enclosed in a separate pouch.

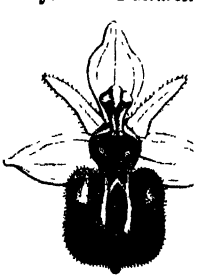
1. O. *muscifera* (*Fly Orchis*). Lip twice as long as the sepals, flat, with 4 expanded lobes, somewhat downy ; the disk polished. Petals linear, smooth.———*Chalky downs.*

2. O. *aranifera* (*Spider Orchis*). Lip the length of the sepals, tumid, hairy, rounded, emarginate, with 4 shallow, reflexed, marginal lobes. Sepals herbaceous. Petals linear, smooth.———*Chalky downs.*

3. O. *apifera* (*Bee Orchis*). Lip roundish obovate, convex, tumid, velvety, variegated, obscurely 5-cleft, with the point reflexed. Petals short, hairy.———*Pastures.*

N.B. The flowers of all the species of Ophrys are singularly like insects, in consequence of the form and marking of the lip, which is usually hairy. Hence the names "Fly," "Spider" and "Bee" given to our native species. Their general appearance will be understood from the following cuts of two exotic species cultivated in some gardens.

Ophrys vespifera



Ophrys mammosa

GYMNADENIA.

The flower of Orchis. But the cells of the anther are not lengthened at the base, and touch there; and the glands of the pollen-masses are naked. (There is little to distinguish the genus from Platanthera, except the contiguity of the base of the anther lobes; and the plicature of the intervening *rostellum*—*i.e.* superior edge of the stigma.)

1. G. *conopsea*. Tubercles of root palmate. Leaves narrow. Spike dense cylindrical. Lip 3-lobed with obtuse entire equal divisions. Spur long, filiform, curved. ——*Dry pastures and Heaths.* Flowers purple, very fragrant.

LISTERA.

Anther dorsal. Pollen powdery. Sepals and petals herbaceous, reflexed. Lip free, pendulous, bifid. Column short, fleshy, free. Anther-bed cucullate.

1. L. *ovata* (*Twayblade*). Root creeping. Stem 2-leaved in the middle. Leaves roundish oval.——*Pastures, orchards and woods.* Stem downy. Flowers yellowish-green, distant.

NEOTTIA.

Flowers as in Listera, except that the column is long, with a flat anther-bed.

1. N. *Nidus avis* (*Bird's-nest Orchis*). A brown leafless plant, with a root composed of numerous thick fleshy entangled fibres. Stem covered with brown scales. Flowers spiked, dingy brown.——*Shady woods*, occasionally. Its English name alludes to the entangled roots, which resemble a bird's nest. The young student must not confound it with the brown leafless Orobanches (p. 104), which are Corolliflora Exogens with a superior capsule, and separate didynamous stamens.

EPIPACTIS.

Anther dorsal. Pollen powdery. Sepals and petals erect, equal in size and form. Lip oblong, interrupted in the middle, concave at the base. Column short.

1. E. *palustris* (*Marsh Helleborine*). Raceme short, few-flowered. Lower bracts shorter than the flowers. Terminal lobe of lip roundish wavy with 2 plates at the base. ——*Marshes.* Flowers pink.

2. E. *latifolia* (*Common Helleborine*). Raceme long, many-flowered. Lower bracts longer than the flowers. Terminal lobe of lip cordate, acuminate, with a pair of warts at the base.—— ——*Woods.* Flowers greenish-purple, green, or purple.

CEPHALANTHERA.

Like Epipactis. But the anther is terminal, not dorsal, the column long, and the terminal lobe of the lip has neither plates nor warts.

1. C. *pallens*. Bracts leafy, longer than the smooth ovary.——*Thickets in calcareous districts.* Flowers large, white.

ORDER LXVI. IRIDACEÆ—IRIDS.

ESSENTIAL CHARACTER.—*Calyx* and *corolla* superior, their divisions either partially cohering, or entirely separate, sometimes irregular, the 3 petals being sometimes very short. *Stamens* 3, arising from the base of the sepals; *anthers* bursting externally lengthwise. *Ovary* 3-celled, cells many-seeded; *style* 1; *stigmas* 3; often petaloid, sometimes 2-lipped. *Capsule* 3-celled, 3-valved, with a loculicidal dehiscence. *Seeds* attached to the inner angle of the cell. — *Herbaceous* plants. *Roots* tuberous or fibrous. *Leaves*

equitant, distichous, in most genera. *Inflorescence* terminal, in spikes, corymbs, or panicles, or crowded. *Bracts* spathaceous, the partial ones often scarious: the *sepals* occasionally rather herbaceous.

*** These are the only triandrous Endogens with a superior perianth.

CROCUS.

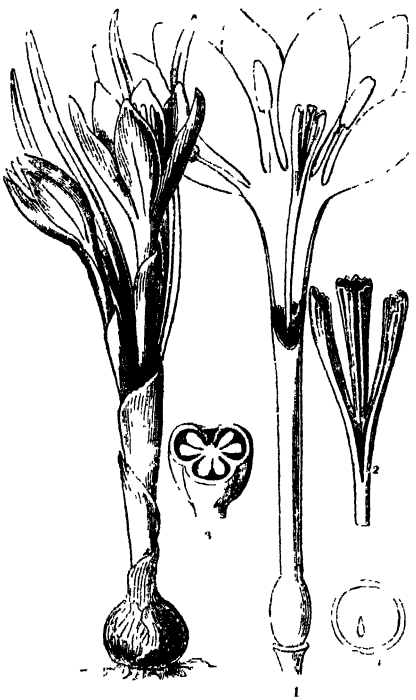


Fig. CCXXV.

Perianth with a slender tube twice as long as the limb, which is 6-parted, equal, inflated, erect. Stigmas 3, convolute, many-lobed.

1. C. *vernus* (*Spring Crocus*). Flowers purple. Stigma within the flower, in 3 short, wedge-shaped, jagged lobes. Tube hairy at the mouth.——*Pastures and gardens.* Flowers in the spring. There are many varieties, some of which have white flowers; they are easily known by the throat of the flower being always furnished with hairs. The other white-flowered spring crocusses belong to C. *biflorus*, or *versicolor*.

2. C. *sativus* (*Saffron Crocus*). Flowers purple. Stigma hanging down laterally, in 3 deep, linear, notched segments.——*Gardens.* Flowers in the autumn. The deep orange stigmas, when dried, become the substance called saffron, used by dyers, and for the purpose of giving a yellow colour to cakes.

3. C. *biflorus* (*The Scotch Crocus*). Flowers white, with a greyish purple pencilling at the back. Stigma somewhat truncated, sweet-scented, within the flower. Tube yellow and smooth at the mouth. Skin of the root cut into rings by circular inci-

and Mediterranean. Flowers in the spring. Although called the Scotch crocus, this plant is really a native of the South-east of Europe.

4. C. *versicolor* (*The Sweet Spring Crocus*). Flowers sweet-scented, very like those of C. *biflorus*. Skin of root not cut into circular rings, but composed of hard parallel fibres.——*Gardens. Mediterranean.*

5. C. *lagenaeflorus* (*The Spring Yellow Crocus*). Flowers yellow, with the segments always erect. Stigmas pallid, enclosed within the flower. Tube smooth at the mouth. Skin of the root not cut into rings, but having fine parallel fibres.——*Gardens; Greece and the Levant.* There are many varieties of this beautiful spring flower. *The large yellow* (C. *luteus*) has very large flowers without any streaks. *The small yellow* (C. *stellaris*) has the sepals and tube streaked with brown externally.

6. C. *reticulatus* (*The Cloth of Gold Crocus*). Flowers yellow, with the sepals rolling backward. Tube smooth at the mouth. Skin of the root marked with a very coarse netting.——*Gardens; South-west of Europe.* The sepals have a deep brown streaking at the back. Flowers in the spring.

GLADIOLUS.

Perianth coloured, 6-parted, irregular, 2-lipped. Stigmas 3, dilated upwards. Stamens ascending. Seeds winged.

1. G. *communis* (*Corn Flag*). Stem 5-8-flowered. Flowers secund, with the tube half as long again as the ovary. Stigmas dilated upwards.——*Gardens.* Flowers rosy purple, marked with letter-like spots in the orifice.

Fig. CCXXV.—Crocus vernus. 1. A flower split open; 2. the stigmata; 3. a transverse section of the ovary; 4. a section of the seed to show the embryo.

IRIS.

Perianth 6-parted; the sepals larger and spreading, the petals smaller and erect.

Fig. CCXXVI.

Stamens distinct, opposite the sepals. Styles 3, very large, petaloid, opposite the sepals, and incumbent upon the stamens

1. I. *germanica*. Flowers bearded. Leaves ensiform, falcate, shorter than the many-flowered stem. Spathes membranous, herbaceous at the base. Tube of the flower 2 or 3 times as long as the ovary. Petals oval, entire at the point.—— —— *Gardens*. Flowers purple

2. I. *Pseudacorus*. Flowers beardless; petals smaller than the styles. Leaves sword-shaped. Seeds angular —— *Marshes*. Flowers yellow.

ORDER LXVII. AMARYLLIDACEÆ—AMARYLLIDS.

Essential Character.—*Calyx* and *corolla* superior, regular coloured. *Stamens* 6, arising from the sepals and petals, sometimes cohering by their dilated bases into a kind of cup; sometimes an additional series of barren stamens is present, often forming a cup which surmounts the tube of the perianth; *anthers* bursting inwardly. *Ovary* 3-celled, the cells many-seeded, or sometimes 1- or 2-seeded; *style* 1; *stigma* 3-lobed. *Fruit* either a 3-celled 3-valved *capsule*, with loculicidal dehiscence, or a 1-3-seeded berry.—Generally *bulbous*, sometimes *fibrous*-rooted. *Leaves* ensiform. *Flowers* usually with spathaceous bracts.

Fig. CCXXVI.—Flower style and stigmas of Iris germanica, with a stamen *s* in sight, *t* the tube of the flower, *o* ovary.

*** The six stamens readily distinguish these from Iridaceæ, and the inferior ovary from Liliaceæ, and Melanthaceæ.

NARCISSUS.

Perianth funnel-shaped, with a spreading, 6-parted limb, surrounded at the orifice of the tube by a cup. Stamens 6, inserted in the tube, and concealed within the cup.

1. N. *Pseudo-Narcissus* (*Daffodil*). Flowers solitary. Cup bell-shaped, erect, crisped, with 6 marginal segments; its length equal to that of the ovate petals.——— *Woods.*

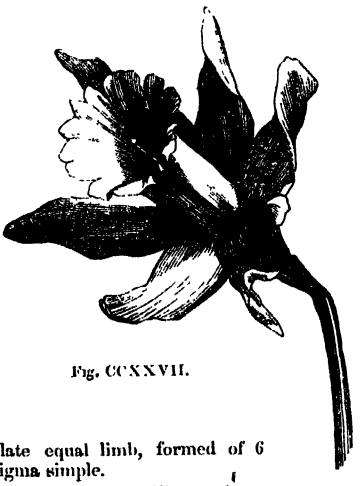


Fig. CCXXVII.

GALANTHUS.

Perianth in 6 pieces; the petals twice as short as the sepals, and emarginate. Stigma simple.

1. G. *nivalis* (*Snowdrop*). Leaves not plaited. Flowers white, nodding.——— *Meadows and Groves. Gardens.* The earliest of common spring flowers.

LEUCOJUM.

Perianth with a short tube, and a campanulate equal limb, formed of 6 pieces, which are thickish at the apex. Stigma simple.

1. L. *æstivum* (*Snowflake*). Spathe many flowered. Style filiform-clavate. *Gardens.* Flowers white, nodding.

ORDER LXVIII. LILIACEÆ—LILYWORTS.

Essential Character.—*Calyx* and *corolla*, coloured, regular, occasionally cohering in a tube. *Stamens* 6, inserted into the sepals and petals; *anthers* opening inwards. *Ovary* superior, 3-celled, many-seeded; *style* 1; *stigma* simple, or 3-lobed. *Fruit* succulent, or dry and capsular, 3-celled. —*Stem* none, except a bulb; or tuberous, creeping, erect, or arborescent. *Leaves* not articulated with the stem; either sessile or with a narrow leafy petiole.

ORNITHOGALUM,

Perianth 6-leaved, spreading flat. Staminal scales absent. Stamens hypogynous, or very slightly perigynous. Seeds roundish or angular. Peduncles not jointed. Spathe 0.

N.B. This genus scarcely differs from Scilla except in having white not blue flowers. In Scilla the perigynous stamens are very striking: and then the distinction is obvious; but in some Ornithogalums there is a distinct union between the filaments and the base of the sepals or petals.

1. O. *pyrenaicum* (*Bath Asparagus*). Leaves broad-linear, channelled, synanthious (*i.e.* appearing with the flowers). Stamens simple. Raceme long, many-flowered; Peduncles spreading, except in fruit when they become erect. Divisions of perianth linear-oblong obtuse.——— *Pastures. Common in Gardens.* Flowers greenish white. The young tender scapes are sometimes brought to market as a substitute for Asparagus.

2. O. *nutans*. Leaves linear, smooth, synanthious. Stamens trifid, alternately shorter. Flowers racemose, secund, drooping.——— *Orchards, &c.* Flowers externally green, with a white edge to the segments.

CONVALLARIA.

Sepals and petals united in a perianth, which is either globose or cylindrical, and 6-toothed, stamens 6. Berry round, before maturity spotted, 3-celled, with 1-seeded cells.

Fig. CCXXVII.—Flower of Narcissus Pseudo-Narcissus.

1. C. *majalis* (*Lily of the Valley*). Flower-stalk radical, naked, semicylindrical. Raceme simple. Flowers drooping, cup-shaped, with rather distinct segments.——— *Woods and Meadows.*

TULIPA.

Perianth campanulate, of 6 pieces, without honey-pores at the base. Stigmas 3, thick, sessile. Capsule oblong, 3-cornered. Seeds flat.

1. T. *sylvestris* (*Wild Tulip*). Flowers solitary, a little drooping. Leaves lanceolate. Stigma triangular, abrupt. Stamens hairy at the base.——— *Pastures.* Flowers yellow.

LILIUM.

Perianth 6-leaved, campanulate, more or less revolute, at the edge; the segments marked at the base with a longitudinal nectariferous furrow. Style undivided; stigma 3-cornered. Seeds flat.

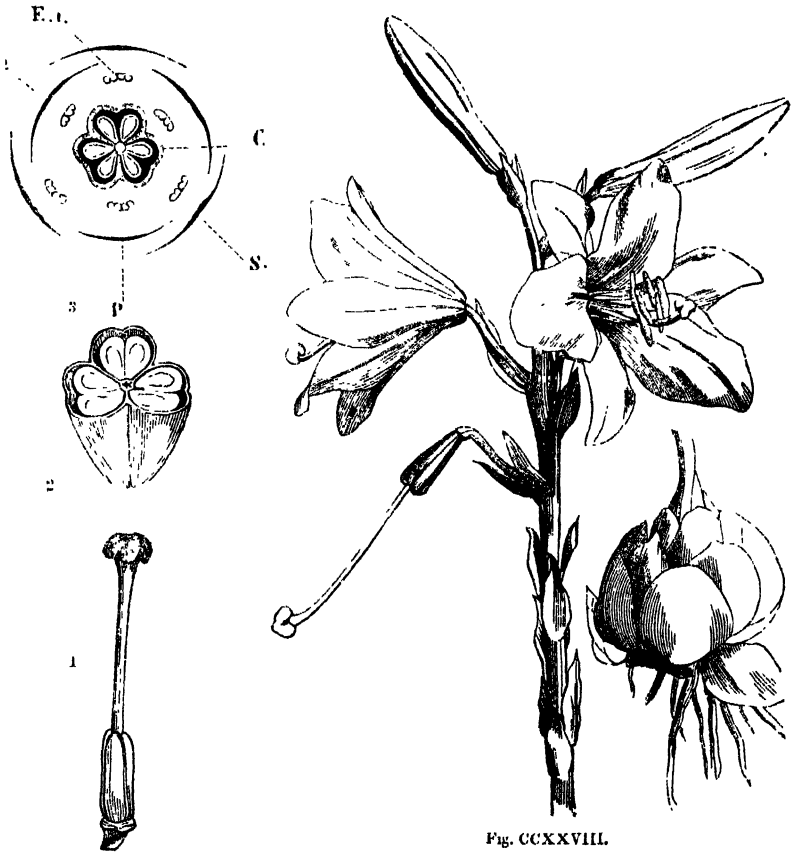


Fig. CCXXVIII.

1. L. *candidum* (*White Lily*). Leaves lanceolate, alternate, wavy. Flowers white, stalked, terminal, smooth inside.———*Gardens.*

2. L. *bulbiferum* (*Orange Lily*). Leaves alternate. Flowers erect. Perianth campanulate, scabrous with warts inside.———*Gardens.*

Fig. CCXXVIII.—Lilium candidum. 1. The pistil; 2. a cross section of the ovary; 3. a diagram of the structure. *s* sepals, *p* petals, *c* stamens, *r* carpels.

3. L. *Martagon* (*Turk's Cap*). Leaves whorled, elliptical-lanceolate, acuminate, rough at the edge. Stem rough with down. Flowers nodding, with the segments rolled back.———*Mountain woods of central Europe. Gardens.* Flowers dull pale violet, with small brownish spots.

4. L. *tigrinum* (*Tiger Lily*). Stem loosely woolly. Leaves scattered, sessile, narrowly lanceolate, bearing bulbs in their axils. Flowers panicled, nodding, with the segments rolled back, warted inside.———*Gardens. China and Japan.* Flowers large, orange-red, with purple spots.

5. L. *Chalcedonicum* (*Lily of the Field*). Stem slightly rough, especially in the shallow furrows. Leaves scattered, lanceolate-linear, obtuse, smooth beneath, roughish with down at the edge. Flowers nodding, panicled, with the segments rolled back.———*Palestine. Gardens.* Flowers scarlet, with warts of the same colour. This is the "lily of the field" of the New Testament.

ASPARAGUS

Perianth 6-parted, spreading, equal, deciduous. Stamens 6, inserted in the base of the sepals and petals. Filaments subulate, smooth. Anthers peltate, erect. Ovary with 2-seeded cells. Style short, with 3 furrows. Stigma 3-lobed. Berry round, with from 1 to 3 cells, and few seeds.

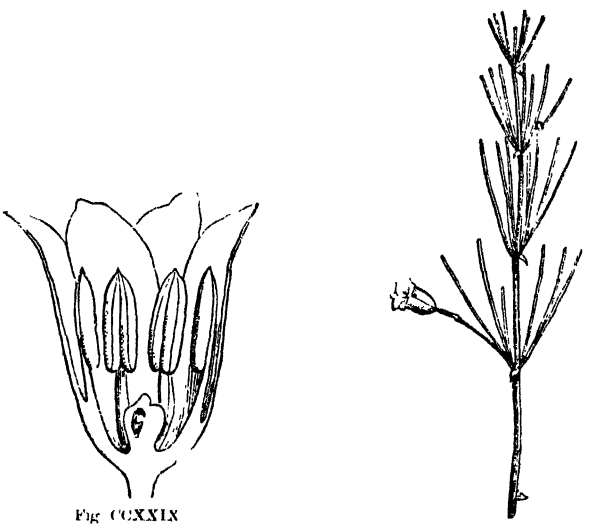


Fig. CCXXIX.

1. A. *officinalis* (*Asparagus*). Stem herbaceous, round, erect, without prickles. Leaves scarious. Sterile branches bristle-shaped, flexible. Stipules mostly solitary.———*Sea-coasts and gardens.* The succulent suckers are the asparagus, commonly eaten as a vegetable.

HEMEROCALLIS

Perianth funnel-shaped, oblique; tube cylindrical, monopetalous; limb 6-parted. Stamens almost hypogynous, subulate, curved downwards (declinate). Seeds globose.

1. H. *fulva*. Segments of the flower ribbed and veiny; petals wavy at the edge.———*Continental meadows. Gardens.* Flowers fulvous (dark brownish yellow).

ASPHODELUS.

Perianth deeply 6-parted, spreading. Stamens placed upon dilated scales which conceal the ovary. Style undivided. Seeds angular.

1. A. *ramosus*. Leaves all radical. Stem leafless, branched. Branches racemose. Flowers dense. Staminal scales roundish-obovate, very obtuse, abrupt. Stamens little declinate.———*South of Europe. Common in gardens.* Flowers white.

2. A. *albus*. Leaves all radical. Stem leafless, simple. Raceme dense. Staminal

Fig. CCXXIX.—1. Branch of Asparagus officinalis in flower; 2 a vertical section of a flower, magnified.

scales oblong-lanceolate acuminate. Stamens scarcely declinate.———*Germany, &c. Common in gardens.* Flowers white.

3. A. *lutcus.* Radical leaves subulate-striated, 3-cornered. Stem simple, clothed with leaf-sheaths up to the flowers, which are densely arranged. Stamens all declinate.——*South of Europe. Gardens.* Flowers yellow. Fruit baccate.

ANTHERICUM.

Perianth six-leaved, spreading. Staminal scales absent. Stamens exactly hypogynous. Style declinate. Seeds angular. Pedicels jointed.

1. A. *Liliago.* Leaves linear, somewhat channelled, erect, shorter than the simple scape.———*Mountains of Europe. Gardens.* Flowers small, white.

CZACKIA.

Perianth 6-leaved, funnel-shaped. Staminal scales abrupt. Stamens inserted on the top of a short stipe which carries the ovary, declinate, as well as the style. Seeds angular. Pedicel jointless.

1. C. *Liliastrum.* Flowers large, white, somewhat resembling those of Lilium candidum, but small and more transparent.———*Switzerland, &c. Common in gardens,* where it is usually called Anthericum Liliastrum.

Fig. CCXXIX. *b.*

Fig. CCXXIX. *b* —Fritillaria Imperialis.

FRITILLARIA.

Perianth campanulate, of 6 pieces, with an oval honey-pore at their base. Stigmas 3. Seeds flat.

1. F. *Meleagris* (*Fritillary*). All the leaves alternate, linear-lanceolate, pointed. Stem single-flowered. Honey-pore linear. Points of the perianth inflexed.——*Gardens.*

2. F. *imperialis* (*Crown Imperial*). Flowers collected in a head surmounted by leafy long green bracts.——*Gardens.* Bulbs with a heavy foxy smell.

ALLIUM.

Perianth 6-parted, spreading. Stigma simple. Capsule 3-angular, the cells deeply parted in 2, separating from a permanent filiform axis.—Flowers in terminal umbels, enclosed in a spathe or spathes.

1. A. *sativum* (*Garlic*). Stem round, leafy as high as the middle. Leaves broad, linear, flat, somewhat channelled. Spathe with a very long beak. Umbels bulbiferous. Alternate stamens with 2 teeth at the base. Bulb compound.——*Gardens.*

2. A. *Cepa* (*Onion*). Stem leafy at the base, inflated below the middle. Leaves fistular, ventricose. Umbel not bulbous, globose. Stamens longer than the perianth, alternately 2-toothed at the base.——*Gardens.*

3. A. *Scorodoprasum* (*Chives*). Stalk naked, round, the height of the foliage. Leaves cylindrical, somewhat tapering at the point. Stamens simple.——*Gardens.*

HYACINTHUS.

Perianth 6-cleft, tubular; segments spreading at the apex. Stamens inserted about the middle of the perianth. Capsule obtusely 3-cornered; cells many-seeded.

Fig. CCXXX.

1. H. *nutans* (*Hardbell*). Leaves linear. Bracts in pairs. Raceme nodding ——*Thickets.*

The common garden Hyacinth, the bulbs of which are sold in the shops under the name of Dutch roots, is Hyacinthus orientalis. It is generally in a double state.

MUSCARI.

Perianth ovate, inflated, 6-toothed. Capsule 3-cornered, with prominent angles. Cells 2-seeded.

1. M. *racemosum* (*Starch Hyacinth*). Flowers ovate, with 6 furrows; the upper ones sessile and abortive. Leaves linear, channelled, flaccid.——*Gardens.*

2. M. *comosum*. Flowers angular, cylindrical, the lower remote, and spreading horizontally; the upper barren, imperfect, and erect. Leaves linear, channelled.——*Gardens.*

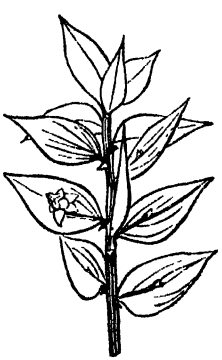


Fig. CCXXXI.

RUSCUS.

Flowers dioecious. Perianth 6-parted.—*Males.* Filaments united into a tube, with 3 anthers.—*Females.* Stamens sterile. Style 1. Stigma capitate. Berry 3-celled, with 2-seeded cells.

1. R. *aculeatus* (*Butcher's Broom*). Leaves ovate, mucronate, acuminate, having the flower on the upper side. Fascicles somewhat 2-flowered, with a minute bract at the base.——*Woods.*

Fig. CCXXX.—The double oriental Hyacinth. Fig. CCXXXI.—Ruscus aculeatus.

ERYTHRONIUM.

Perianth 6-leaved, campanulate at the base, then spreading, afterwards reflexed; two of the petals callous at the base inside. Style trifid. Seeds rounded.

1. E. *Dens Canis* (*Dog's Tooth Violet.*) Leaves 2, oblong-elliptical, blotched with purple. Segments of the perianth acute.———*Gardens.*

ORDER LXIX. MELANTHACEÆ - MELANTHS.

ESSENTIAL CHARACTER.—*Perianth* inferior, petaloid, in 6 pieces, or, in consequence of the cohesion of the claws, tubular. *Stamens* 6; *anthers* turned outwards. *Ovary* 3-celled, many-seeded; *style* trifid, or 3-parted; *stigmas* undivided.—*Capsule* generally divisible into three pieces; sometimes with a loculicidal dehiscence.—*Roots* fibrous, sometimes fascicled. *Rhizoma* sometimes fleshy. *Leaves* sheathing at the base, with parallel veins. *Flowers* either arising from under the surface of the ground, or upon a leafy stem.

*** No Endogenous plants except these have a 3-parted superior pistil, and 6 stamens, with the anthers turned outwards.

COLCHICUM.

Perianth tubular, long, with a campanulate 6-parted limb. Stamens inserted in the orifice of the tube. Anthers oblong, versatile. Ovary 1. Styles 3, very long. Follicles 3, inflated, erect, united at the base, many-seeded.

1. C. *autumnale* (*Meadow Saffron*). Leaves flat, lanceolate, erect. Segments of the corolla oblong. Flowers purple or white, appearing in the autumn; leaves in the spring. ———*Pastures.* Poisonous.

VERATRUM.

Perianth 6-leaved. Anthers bursting transversely into 2 valves. Capsules 3, united at the base, many-seeded. Seeds plano-compressed or winged at the apex.

1. V. *album* (*White Hellebore*). Leaves elliptical, ribbed, downy beneath. Racemes panicled, downy. Bracts longer than the pedicels.———*Gardens* Poisonous.

ORDER LXX. TYPHACEÆ—TYPHADS.

ESSENTIAL CHARACTER.—*Flowers* unisexual, arranged upon a naked spadix. *Sepals* 3, or more, sometimes a mere bundle of hairs. *Petals* wanting. *Males:* *Stamens* 3 or 6, *anthers* wedge-shaped, attached by their base to long filaments, which are sometimes monadelphous. *Females:* *Ovary* single, superior, 1-celled; *ovule* solitary, pendulous; *style* short; *stigmas* 1 or 2, simple, linear. *Fruit* dry, not opening, 1-celled, 1-seeded. *Herbaceous* plants, growing in marshes or ditches. *Stems* without nodi. *Leaves* rigid, ensiform, with parallel veins. *Spadix* without a spathe.

*** The very imperfect flowers of this order, the long weak filaments bearing wedge-shaped anthers, and the 1-celled, 1-seeded fruit, are its principal marks.

TYPHA.

Spikes cylindrical.—*Males.* Sepals 3, imperfect. Stamens 3, united at the base into 1. —*Females.* Sepals several, filiform, surrounding the stalk of the fruit.

1. T. *latifolia* (*Bulrush*). Leaves somewhat convex beneath. Catkin continuous. Receptacle hairy. ——— *Marshes, ponds, &c.* Heads of flowers long, black, cylindrical, resembling a gun-sponge in miniature.

SPARGANIUM.

Spikes round. Sepals 3. Stamens 6; anthers wedge-shaped. Fruit sessile, turbinate, without bristles at the base.

1. S. *ramosum*. Leaves triangular at the base, with concave sides. Common flower-stalks branched. Stigmas linear.——*Marshes and ditches.*

ORDER LXXI. ARACEÆ—ARADS.

ESSENTIAL CHARACTER.—*Flowers* unisexual, arranged upon a spadix, within a spathe. *Perianth* wanting. *Males: Stamens* definite or indefinite, very short. *Females: Ovary* superior, 1-celled, very seldom 3-celled, and many-seeded; *ovules* erect, pendulous, or parietal; *stigma* sessile. *Fruit* succulent. *Seeds* pulpy.—*Herbaceous* plants, frequently with a fleshy *cormus*, or *shrubs;* stemless or arborescent, or climbing by means of aerial roots. *Leaves* sheathing at the base, convolute in the bud, either with parallel or branching veins. *Spadix* generally enclosed in a *spathe*.

*** The naked flowers enclosed in a large hooded spathe, and arranged on a spadix, render it impossible to mistake this order

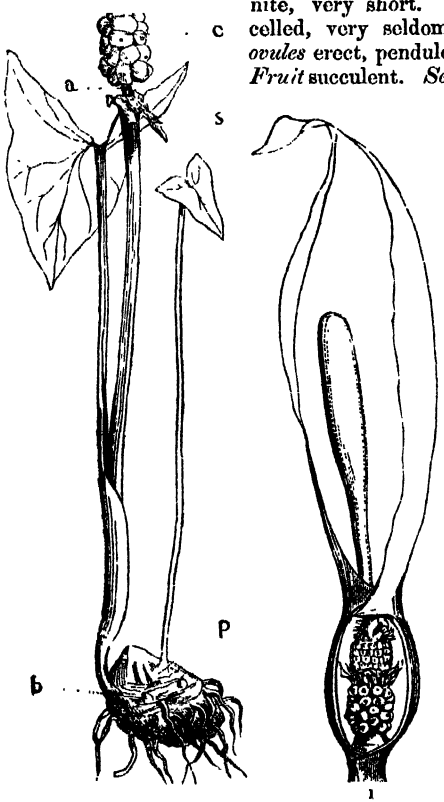


Fig. CCXXXII.

ARUM.

Spadix naked at the apex, enclosed in a spathe. Flowers naked, the males crowded about the middle of the spadix; the females seated at the base. Berry 1-celled, many-seeded.

1. A. *maculatum*. Stem none. Leaves halberd-shaped, entire. Common stalk of the flowers club-shaped, obtuse. —— *Hedgerows.*

2. A. *Dracunculus*. Radical leaves pedate, with entire lobes. Spadix lanceolate, longer than the ovate flat spathe. ——— *Gardens.* Stalks of the leaves banded and spotted with dull purple.

Fig. CCXXXII.—Arum maculatum 1. The spathe cut open at base to show the flowers; 2. in fruit; *b p* the tuber, *s* the remains of the spathe, *a* the base of the spadix, *c* the fruits.

ORDER LXXII. CYPERACEÆ—SEDGES.

ESSENTIAL CHARACTER.—*Flowers* hermaphrodite or unisexual, consisting of imbricated bracts. *Perianth* none, unless the glumes, when present, be so considered, or the hypogynous setæ. *Stamens* hypogynous, definite; *anthers* fixed by their base, entire, 2-celled. *Ovary* 1-seeded, often surrounded by bristles called hypogynous setæ; *style* single, trifid, or bifid; *stigmas* undivided, occasionally bifid. *Nut* crustaceous or bony. *Albumen* of the same figure as the seed; *embryo* lenticular, undivided, enclosed within the base of the albumen.—*Roots* fibrous. *Stems* very often without joints, 3-cornered or taper. *Leaves* with their sheaths entire. The lowermost bracts often sterile.

*** Very like Graminaceæ, but readily known by the stem being solid, the sheaths of the leaves undivided, and the want of paleæ.

CAREX.

Spikes bisexual or unisexual (dicœcious or androgynous). Bracteæ single. Glumes of the male florets wanting, of the female 2, united at the margins, ribbed, becoming hard, and enclosing a nut. Style 2- or 3-parted. Hypogynous setæ wanting.

Fig. CCXXXIII.

Fig. CCXXXIII.—Carex riparia. 1. ♂ flower; 2. ♀ *u* utricle, *st.* style; 3. perpendicular section of the fruit, *s* seed-vessel, *te.* testa, *alb.* albumen, *pl.* embryo.

1. C. *acuta*. Stigmas 2. Spikes cylindrical, slender; drooping in flower; afterwards erect. Fruit elliptical, with a blunt undivided beak. ——— *Ditches.*

2. C. *præcox*. Sheaths about equal to the very short flower-stalks. Spikes all elliptical, rather crowded. Bracteæ of the fertile ones pointed. Fruit pear-shaped, downy, with an abrupt, entire point. ——— *Heaths.*

3. C. *strigosa*. Sheaths nearly equal to the flower-stalks. Spikes slender, loose, slightly drooping. Fruit lanceolate, triangular, ribbed. ——— *Woods and ditches.*

4. C. *distans*. Sheaths tubular, elongated, nearly equal to the flower-stalks. Fertile spikes elliptic-oblong, widely distant. Bracteæ pointed. Stem smooth. —— *Meadows and ditches.*

5. C. *hirta*. Herbage hairy. Fertile spikes ovate-cylindrical, remote. Bracteæ awned. Sheaths nearly as long as the flower-stalks. Fruit hairy, tumid, with a deeply cloven beak. Stem rough-edged. ——— *Ditches, &c.*

6. C. *riparia*. Stigmas 3. Spikes erect, with taper pointed bracteæ. Fruit ovate, tumid, with a deeply cloven beak. ——— *Ponds and marshy places.*

SCHŒNUS.

Spikes terminal. Involucre 2- or many-leaved. Rachis nearly straight Lower bracteæ smaller than the rest, and empty. Hypogynous setæ 0. Fruit 3-cornered, with a very short point. Style filiform, deciduous.

1. S *mucronatus*. Stem taper, naked. Head terminal, hemispherical. Involucre 3-6-leaved, spreading. Leaves linear, somewhat channelled. ——— *Sea banks.*

SCIRPUS.

Spikes lateral or terminal. Rachis nearly straight. Bracteæ gradually diminishing in size. Hypogynous setæ shorter than the bracteæ, or nearly of the same length Style filiform, 2- or 3-parted, deciduous. Fruit 2-edged or 3-cornered, mucronate, usually plano-convex.

1. S. *lacustris*. Stem round, naked. Panicle cymose, twice compound, terminal. Spikes ovate. Involucral leaves generally much shorter than the panicle. ——— *Ponds*

ERIOPHORUM.

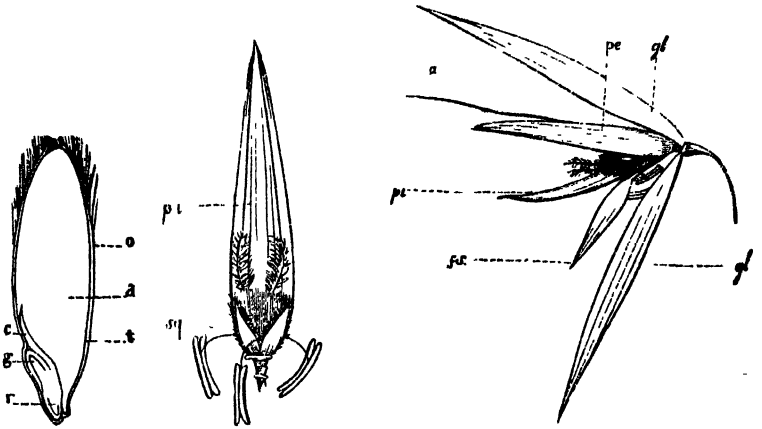
Spike terminal. Rachis nearly straight. Bracteæ gradually diminishing in size. Hypogynous setæ much longer than the bracteæ, persistent. Style 2- or 3-parted, filiform, deciduous. Fruit 3-cornered, pointed.

1. E. *polystachyon* (*Cotton Grass*). Stem round. Leaves flat, lanceolate, with a triangular point. Stalks of the spikes smooth. Setæ thrice the length of the spike. —— *Wet heaths.*

ORDER LXXIII. GRAMINACEÆ—GRASSES.

ESSENTIAL CHARACTER. — *Flowers* usually hermaphrodite, sometimes monœcious or polygamous; consisting of imbricated bracts, of which the most exterior are called *glumes*, the interior immediately enclosing the stamens *paleæ*, and the innermost at the base of the ovarium *scales*. *Glumes* usually 2, alternate; sometimes single, most commonly unequal. *Paleæ* 2, alternate; the lower or exterior simple, the upper or interior composed of 2 united by their contiguous margins, and usually with 2 keels, together forming a kind of dislocated calyx. *Scales* 2 or 3, sometimes wanting. *Stamens* hypogynous; *anthers* versatile. *Ovary* simple; *styles* 2, very rarely 1 or 3; *stigmas* feathery or hairy. *Pericarp* usually undistinguishable from the seed, membranous. *Albumen* farinaceous; *embryo* lying on one side of the albumen at the base, lenticular.—*Rhizoma* fibrous or bulbous. *Culms* cylindrical, usually fistular, closed at the joints,

covered with a coat of silex. *Leaves* alternate, with a split sheath. *Flowers*



in little spikes called *locustæ*, arranged in a spiked, racemed, or panicled manner.

PHLEUM.

Panicle contracted, resembling a spike. Glumes 2, keeled, equal, longer than the palea, with an awn proceeding from their midrib. Paleæ 2, of equal length, awnless, membranaceous, ribbed. Styles half pencil-shaped.

1. P. *pratense* (*Cat's-tail Grass*). Inflorescence, cylindrical. Glumes abrupt, fringed at the keel, longer than the awns.——*Meadows and pastures.* This grass forms a large part of all good pastures, and is much used in laying land down to grass. It is very like Alopecurus pratensis; but that has a solitary palea in each floret, with a bristle arising from its base; while Phleum pratense, on the contrary, has two paleæ to each floret, and no bristle at all.

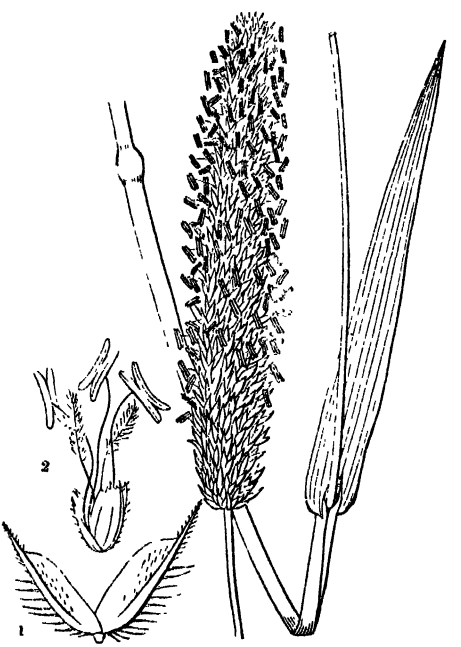


Fig. CCXXXV.

AGROSTIS.

Panicle loose. Glumes 2, nearly equal, the lower larger, longer than the paleæ. Paleæ 2, unequal, the lower larger, sometimes with a dorsal awn. Styles feathery.

1. A. *stolonifera* (*Fiorin Grass*). Panicle condensed at the base of the main divisions; stalks rough. Glumes lanceolate, bristly at the keel. Stem spreading, creeping. Ligula oblong, ribbed.——*Wet places.* Found useful by farmers

Fig CCXXXIV.—Avena sativa. 1. A locusta; *gl.* glumes, *pe.* paleæ, *a.* awn, *fs.* sterile floret; 2. a flower deprived of its outer palea, *pi.* the inner palea, *sq.* hypogynous scales; 3. a perpendicular section of a grain; *c* carpel, *t* testa, *a* albumen, *c* cotyledon, *g* plumule, *r* radicle.
Fig CCXXXV.—Phleum pratense. 1. The glumes; 2. the single floret.

in peaty bad soil, where better grasses will not thrive ; but it is very inferior to some others.

2. A. *vulgaris*. Panicle spreading ; with divaricating capillary branches. Glumes nearly equal. Stem erect. Ligula abrupt, very short.———*Dry banks, &c.*

ANTHOXANTHUM.

Glumes 2, the lower smaller, the upper enfolding the palea, and longer than they. Florets 3 ; the two lateral neuter, the middle hermaphrodite. Palea of the neuter florets single ; one with a dorsal awn, the other with an awn from the base. Palea of the hermaphrodite florets 2, nearly equal, awnless. Stamens 2.

1. A. *odoratum* (*Sweet Vernal Grass*). Panicle resembling a spike, ovate-oblong. Florets longer than their awns, on short partial stalks.———*Dry pastures.* The foliage is very fragrant, and assists in giving the sweet smell to hay.

PHRAGMITES.

Glumes 2. Florets 3-7 ; the lower ♂ and naked, the remainder ♀ and surrounded with silky hairs.

1. P. *communis* (*Common Reed*). Florets about 5, awnless, longer than the glumes. Panicle large, silky, loose.———*Marshes, rivers, ponds, &c.* This is the plant whose straw is made into thatch.

Panicle loose. Spikelets 2-flowered ; lower floret awnless and hermaphrodite ; upper awned and male. Glumes 2, nearly equal, rather longer than the florets Palea 2 ; the lower awnless, or awned under the apex.

1. H *lanatus* (*Woolly Soft Grass*). Glumes rather blunt, mucronate. Upper floret with a curved awn shorter than the glumes. Joints of the stem without a tuft of hair. Roots fibrous.———*Common in fields and hedge-rows.*

2. H. *mollis* (*Creeping Soft Grass*). Glumes partly naked. Lower floret perfect, awnless ; upper with a sharply bent awn longer than the glumes. Joints of the stem very hairy. Leaves slightly downy. Root creeping.———*Bad pastures and fields.* Both these common grasses are of bad quality, and disliked by cattle.

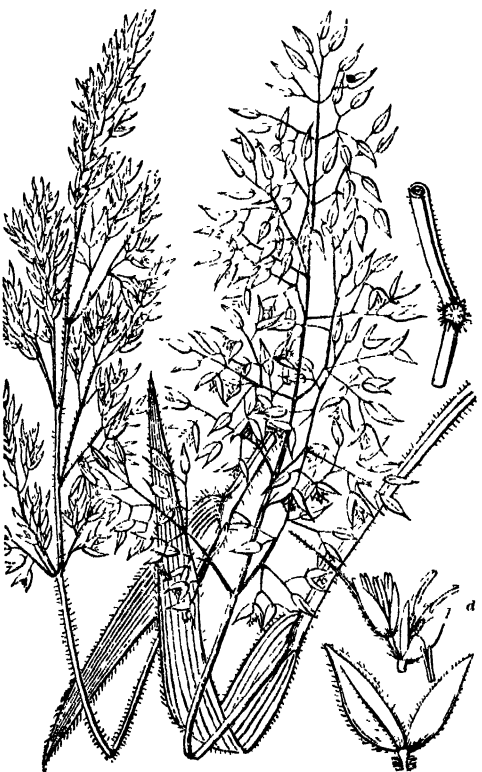


Fig. CCXXXVI.

AVENA.

Panicle loose. Spikelets 2- or many-flowered, upper florets sterile and imperfect. Glumes 2, nearly equal, thin and papery, as long as the palea. Palea 2, the lower bifid, with a twisted awn at the back.

1. A. *sativa* (*Common Oat*). (Fig. CCXXXIV.) Panicle spreading, equal. Glumes generally 2 flowered, and

Fig. CCXXXVI.—*a* Holcus mollis ; *b* Holcus lanatus ; *c* the glumes of the latter ; *d* its florets.

longer than the florets; the upper 9-ribbed. Florets smooth, bifid and toothed at the point.——— *Fields.*

2. A. *orientalis* (*Tartarian Oat*). Panicle contracted, one-sided; glumes generally 2-flowered, longer than the florets; the upper 9-ribbed. Florets smooth, bifid and toothed at the point.———*Fields.*

3. A. *sterilis* (*Animal Oat*). Panicle one-sided. Glumes generally 4-flowered, the upper 9-ribbed. Two lower florets hairy at the lower part, with a long stiff twisted awn.———*Gardens.*

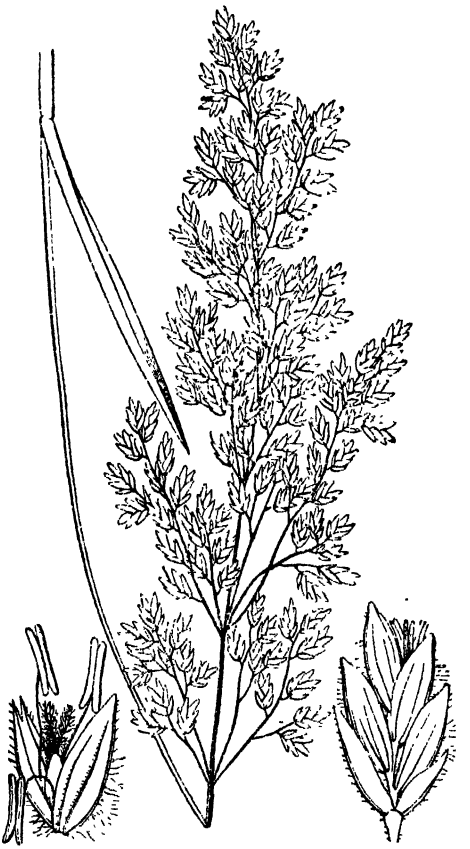
POA.

Panicle loose, seldom contracted. Spikelets 3- or many-flowered, or even 2-flowered, with the pedicels of a greater number of florets; florets articulated with their rachis. Paleæ 2, nearly equal, awnless. Scales oval, acute, gibbous at the base.

1. P. *annua*. Panicle widely spreading. Spikelets ovate, 5-flowered. Florets a little remote, 5-ribbed, without a web. Stems oblique, compressed. ——— *Everywhere.*

2. P. *pratensis* (*Smooth-stalked Meadow Grass*). Panicle spreading. Spikelets 4-flowered. Florets lanceolate, 5-ribbed, connected by a web. Ligula short and obtuse. Stem and leaves smooth. Root creeping.———*Pastures.*

3. P. *trivialis* (*Rough-stalked Meadow Grass*). Panicle spreading. Spikelets oblong-ovate, of about 3 florets which are acute, 5 nerved, and connected by a web. Stem and leaves roughish. Ligula oblong. Root fibrous.——— *Meadows and pastures.* These two are pasture grasses of the finest quality, and very productive. They should form part of all the mixtures of grass seeds used for laying down pasture or lawns.



2 Fig. CCXXXVII.

DACTYLIS.

Panicle loose or contracted; branches solitary; terminal ramifications always very short. Spikelets clustered, many flowered, horizontal. Glumes 2, unequal-sided. Paleæ 2, the lower awned under the apex, the upper of nearly the same size.

1. D. *glomerata* (*Cock's Foot Grass*). Panicle distantly branched. Spikelets in dense globular tufts, unilateral. Paleæ somewhat awned, 5-ribbed, taper-pointed.———*Dry fields.* A coarse, harsh grass; much valued, however, in sandy countries, for the sake of its early herbage. It is one of the first grasses that sheep are able to graze upon.

ALOPECURUS.

Panicle contracted, resembling a spike. Glumes 2, equal, keeled, often connate at the base, about as long as the paleæ. Palea single, with a bristle arising from its base, ribbed. Style single or double, hairy.

Fig CCXXXVII.—Poa pratensis. 1 A spikelet; 2. one of its florets.

1. A. *pratensis* (*Meadow Foxtail Grass*). Stem erect, smooth. Inflorescence ovate, somewhat panicled. Glumes woolly, obliquely abrupt, nearly as long as the awn of the palea.———*Meadows and pastures.* One of the earliest and best of the grasses found in rich pastures.

BRIZA.

Panicle loose. Spikelets many-flowered, cordate. Glumes 2, equal, convex, about as long as the lower florets. Paleæ 2, convex, awnless; their margins not involute. Scales acuminate, gibbous at the base. Styles feathery almost to the base.

1. B. *media* (*Maiden Hair*). Spikelets ovate, about 7-flowered. Glumes shorter than the florets. Ligula very short and blunt.———*Dry pastures*, where it is common, and easily recognised by its small roundish spikelets suspended on delicate stalks, as if scarcely strong enough to bear their weight.

CYNOSURUS.

Panicle contracted. Spikelets 2- or many-flowered, resting upon pinnate bracteæ. Glumes 2, about the same length as the florets. Paleæ 2; the lower awned from the apex or mucronate. Scales lanceolate, acute. Styles feathery or hairy.

1. C. *cristatus* (*Crested Dog's-tail Grass. Gold Seed*). Spike simple, linear. Neuter spikelets without awns.———*Pastures.* A deep rooting grass, with a thin and fine green herbage. It succeeds in upland pastures, which are too dry for other grasses, and is one of the best for laying down lawns.

FESTUCA.

Panicle loose. Spikelets many-flowered, the florets deciduous. Glumes 2, unequal, or nearly equal, acute. Paleæ 2; the lower mucronate or awned at the point. Scales 2, usually toothed.

1. F. *pratensis* (*Meadow Fescue*). Panicle nearly upright, branched, spreading, turned to one side. Spikelets linear, compressed. Florets numerous, cylindrical, obscurely ribbed. Root fibrous.———*Pastures.*

2. *F. duriuscula* (*Hard Fescue*). Panicle somewhat one-sided, contracted. Spikelets oblong of about 6 florets, slightly covered by fine hairs. Paleæ with short awns. Stem leaves nearly flat; those next the root somewhat setaceous. Root creeping or fibrous.———*Pastures and waste places.*

3. *F. ovina* (*Sheep's Fescue*). Panicle small, somewhat one-sided and contracted. Spikelets oblong, of about 4 or 5 florets, with short awns. Stems square upwards. Leaves all setaceous.——*Dry elevated grounds*, where it forms a fine close sward, and is the favourite food of sheep.

All three of these Fescues are valuable to Farmers, the first for low pastures, and the two others for uplands. They are also, especially the last, among the species best suited for lawns and "kept" grass.

Fig. CCXXXVIII.—1. Festuca duriuscula, 2 its spikelet: 3. F. ovina; 4. its spikelet; 5. one of the florets.

Fig. CCXXXIX.

BROMUS.

Panicle loose. Spikelets more than 4-flowered. Glumes 2, unequal, shorter than the lower florets. Palea 2; the lower awned under the apex, very seldom awnless. Scales lanceolate, entire.

1. B. *mollis*. Panicle erect, rather close, compound. Spikelets ovate, downy. Florets imbricated, depressed, ribbed. Awns as long as the glumes. Leaves and sheaths very soft and downy. ——— *Dry fields.*

2. B. *sterilis*. Panicle drooping, mostly simple. Spikelets linear-lanceolate. Florets about 7, lanceolate, compressed, 7-ribbed, furrowed. Awns longer than the glumes. Leaves downy. ——— *Fields and on walls.* The Brome-grasses are all of bad quality, and unfit for cultivation.

TRITICUM.

Spikelets solitary, sessile in notches of the rachis, with which they are parallel. Glumes 2-, 3-, or many-flowered, carinate, acute or mucronate. Palea 2; the lower often awned.

1. T. *repens* (*Couch Grass*). Glumes pointed or awned, lanceolate, many-ribbed. Florets about 5, sharp pointed or awned. Leaves flat. Root creeping. ——— *Fields.*

2. T. *vulgare* (*Wheat*). Ear 4-cornered, imbricated. Rachis tough. Spikelets 3- or 4-flowered. Glumes ventricose, ovate, truncated, mucronate, compressed below the point. Grain naked. ——— *Cultivated in corn fields.* Some varieties are bearded; others not so, as in the accompanying figure.

3. T. *polonicum* (*Polish Wheat*). Ear irregularly 4-cornered, or compressed. Rachis tough. Spikelets generally 3-flowered. Glumes very large, inflated, oblong-lanceolate, thin and papery, conspicuously many-veined. Grain naked. ——— *Cultivated occasionally as a curiosity, but seldom as a field crop in this country.* It seems to require a warmer climate; but is said to be very productive of flour.

4. T. *Spelta* (*Spelt*). Ear narrow, compressed, loose. Rachis brittle. Spikelets generally with four florets. Glumes hard, broadly ovate, truncated, 3-toothed, strongly ribbed, with the rib-tooth straight, and those at the side imperfect. Beardless or bearded. Grain adhering to the paleæ. ——— *Occasionally cultivated in Scotland.* This and a variety called *Far* are little known in England, but are commonly grown in the South of Europe, on poor land. They are easily known by their stiff glumes, loose narrow ears, and grain adhering to the chaff or paleæ, as in common barley. Some varieties are bearded, others are not.

5. T. *compositum* (*Egyptian Wheat*). Ear four-cornered, branched, closely imbricated. Rachis tough. Spikelets generally four-flowered. Glumes inflated, ovate, truncate, mucronate, keeled. Paleæ bearded. Grain naked. ——— *Grown in Egypt.* This is little known in England, but has lately become an object of curiosity in consequence of its having been raised from seeds found in the cases of

Fig. CCXL.

Fig. CCXXXIX. Triticum vulgare, with a separate spikelet.
Fig. CCXL.—Trit cum Spelta, with a separate spikelet.

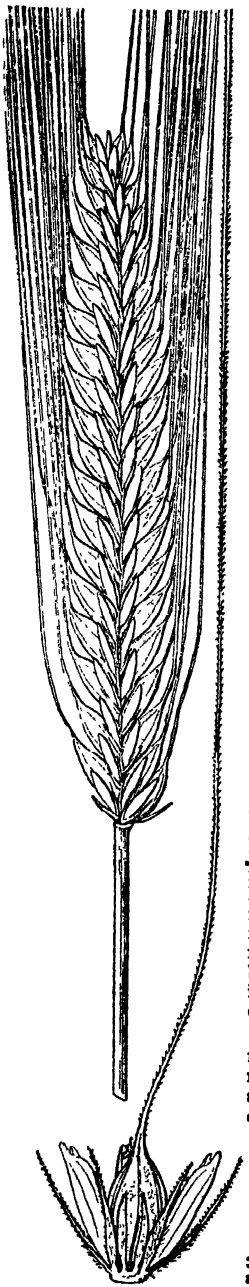


Fig. CCXLI.

Egyptian mummies. Its branched ears are very remarkable.

SECALE.

Glumes subulate. Spikelets 2-flowered, with the rudiment of a third flower in the middle. Otherwise like Triticum.

1. S. *Cereale* (*Rye*). Glumes shorter than the spikelet. Rachis tough. ——— *Fields.* The grain of this sort of corn produces flour inferior to that from wheat, and forming a dark sweet nutritious bread. It is the common food of the peasantry of Germany, but is little used in England.

*** Rye differs from Wheat in having very small narrow glumes, and the centre floret of each spikelet constantly imperfect.

HORDEUM.

Spikelets in pairs or threes, 1-flowered. Glumes 2. Palcæ 2, the lower awned at the apex. Scales obtuse, fringed. Styles feathery. Ovary villous at the end.

1. H. *hexastichon* (*Six-rowed Barley, Winter Barley, Bere, or Bigg*). Spikelets all fertile, arranged in 6 rows. Grain adhering to the palese. ——— *Fields.*

2. H. *distichum* (*Two-rowed or common Barley*). The middle spikelets only fertile, the two lateral of each cluster barren and beardless. One palea of the middle florets furnished with a very long awn. Grain adhering to the palese ——— *Cornfields.* This is the sort of barley commonly grown in England. It prefers light land. Bread is sometimes made from its flour; but it is chiefly used for malting, previously to being fermented for beer. Malt is the grain of barley forced to germinate, by which it acquires sweetness, and then kiln dried.

3. H. *murinum* (*Wall Barley*). Lateral flowers barren. Glumes of the intermediate ones lanceolate, fringed. Grain adhering to the palese. ——— *Walls and waste places.* A worthless weed.

*** Barley differs from Rye, which it somewhat resembles, in having its spikelets one-flowered only, and constantly

Fig. CCXLII.

Fig. CCXLI. Hordeum distichum with 3 spikelets separate, of which the two lateral are sterile, and the central only perfect.
Fig. CCXLII. Secale Cereale with a spikelet separate.

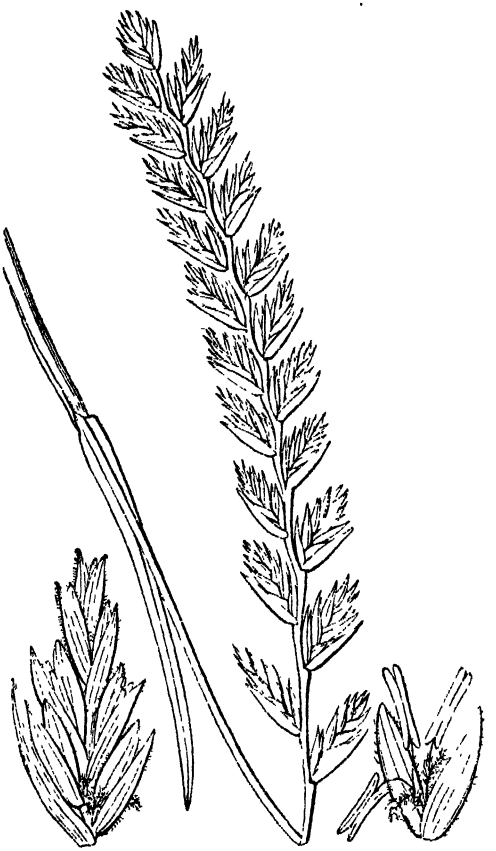
growing in threes. If the whole of the spikelets are fertile, then six-rowed barley is produced; but when the side florets are barren, then two-rowed barley is the result. Some kinds of barley have the seed separate from the chaff or paleæ, like wheat, but they need not be mistaken for wheat; because all the species of Triticum have large glumes containing at least 3 florets.

LOLIUM.

Spikelets many-flowered, at right angles with the rachis. A bractea at the base of the spikelet. Glumes 2, lateral, often deficient. Paleæ 2, nearly equal; the outer often awned under the apex. Scales oval, gibbous, nearly acute. Styles feathery.

1. L. *perenne* (*Ray or Rye Grass*). Paleæ very slightly awned. Spikelets longer than the glumes. Florets lanceolate. ——— *Fields.* This is a valuable meadow grass, much cultivated for artificial pastures. Many varieties are known, of which one called L. perenne italicum produces a very early and bulky herbage, and another named L. perenne tenue has a finer herbage well suited to lawns.

2. L. *temulentum* (*Darnel*). Awns longer than the paleæ. Spikelets shorter than the glumes. Florets elliptical. Stem rough in the upper part. —*Corn-fields.* One of the very few grasses that are poisonous. The seeds mixed with wheat have killed persons who ate bread prepared from such flour. They are powerfully narcotic and very acrid.



2 1 3

Fig. CCXLIII.

GLYCERIA.

Spikelets many-flowered, long, linear, racemose, loose. Florets obtuse, half-cylindrical at the back, somewhat inflated inwards. Otherwise like Poa.

1. G. *fluitans.* Panicle one-sided; the branches when in flower spreading at right angles. Spikelets 7- 11-flowered, pressed close to the branch. Florets blunt, 7-nerved; the ribs strong and prominent Root creeping.———*Common in ponds and wet ditches.*

AIRA.

Spikelets 2-flowered, or having the stalked rudiment of a 3rd, seldom 3-flowered. Florets ☿. Glume compressed, 2-valved. Paleæ 2, the lower awned at the base or in the middle of the back; the awn usually bent in the middle.

1. A. *cæspitosa.* Leaves flat. Panicle large. Pedicels rough. Awn setaceous, generally as long as the paleæ.———*Common in meadows and moist pastures,* where it forms large tussocks.

Fig. CCXLIII. 1. Lolium perenne; 2. one of its spikelets; 3. a floret.

ORYZA.

Flowers panicled. Spikelets one-flowered. Glumes 2, small, unequal, awnless. Paleæ 2, nearly equal, cartilaginous, ribbed; the lower with or without an awn. Stamens 6.

1. O. *sativa* (*Common Rice*). Leaves linear, long. Panicle branched, contracted, with weak rough ramifications. ——— *Occasionally seen in hot-houses, and cultivated in fields in the South of Italy.* This plant which to people in hot countries is what wheat is to us, is one of the few grasses that have six stamens. As seen in the shops the grain is deprived of its coarse harsh paleæ, which, in the ordinary condition, form a hard two-valved case, effectually guarding the grain against injury from common causes.

Although Rice is not cultivated as a corn crop in any part of Great Britain, our summer heat not being sufficient for the common varieties, yet it is not quite certain that it never will be. A hardy sort, called Mountain Rice, has been obtained from the Himalaya mountains, and has been grown in Westphalia and in the Low Countries, and it is evident that the plant possesses considerable powers of adapting itself to circumstances.

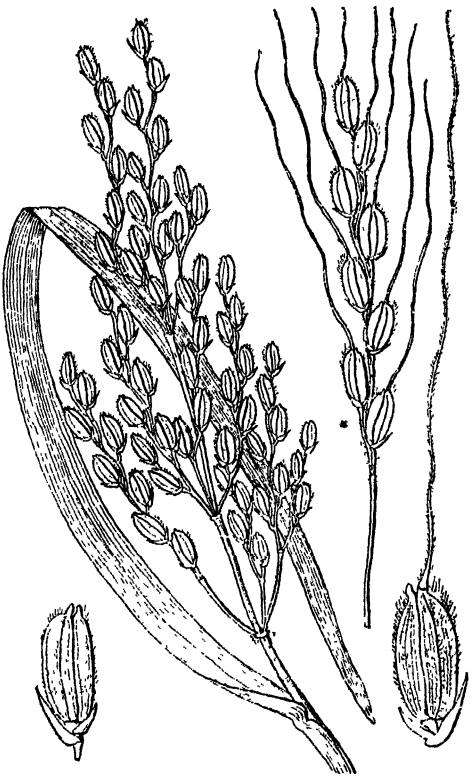


Fig. CCXLIV.

The following orders of this class are also included in the Flora of Europe:—

HYDROCHARACEÆ—HYDROCHARADS.

Essential Character.—*Flowers* hermaphrodite or unisexual. *Sepals* 3, herbaceous. *Petals* 3, petaloid. *Stamens* definite or indefinite. *Ovary* single, inferior, 1- or many-celled; *stigmas* 3-6; *ovules* indefinite, often parietal. *Fruit* dry or succulent, indehiscent, with one or more cells. *Seeds* without albumen; *embryo* undivided, antitropous.—*Floating* or water plants *Leaves* with parallel veins, sometimes spiny. *Flowers* spathaceous.

*** The inferior ovary, and parietal ovules, approximate them to Orchidaceæ, but the stamens are distinct. Amaryllidaceæ differ in their flowers being hexapetaloid; Alismaceæ in having apocarpous fruit. *Hydrocharis Morsus Ranæ* and *Stratiotes aloïdes* are water plants, common in some parts of England.

Fig. CCXLIV.—Oryza sativa. 1. a spikelet with one of the paleæ awned; 2. a beardless spikelet.

JUNCACEÆ—RUSHES.

ESSENTIAL CHARACTER.—*Calyx* and *corolla* forming an inferior, 6-parted, more or less glumaceous *perianth*. *Stamens* 6, inserted into the base of the segments. *Ovary* 1- or 3-celled, 1- or many-seeded, or 1-celled and 3-seeded. *Style* 1. *Stigmas* generally 3. *Fruit* capsular, with 3 valves, which have the dissepiment in their middle, sometimes destitute of valves and 1-seeded by abortion. —*Herbaceous* plants, with fascicled or fibrous roots. *Leaves* fistular, or flat and channelled, with parallel veins. *Inflorescence* often more or less capitate. *Flowers* generally brown or green.

Fig CCXLV.

*** The true *Rushes*, consisting of various species of *Juncus*, belong to this unimportant order, which is little different from Liliaceæ; the principal distinction consists in the calyx and corolla being dry and brown in Juncaceæ. Luzula campestris is a very common little plant in grass fields and lawns.

It is to be observed that what are commonly called Rushes are really Sedges, consisting of the spongy-stemmed Scirpus palustris.

ACORACEÆ—SWEET FLAGS.

ESSENTIAL CHARACTER.—*Flowers* hermaphrodite, surrounded with scales, *Spathe* leaf-like, not rolled up. *Stamens* complete, opposite the scales, with 2-celled anthers turned inwards. *Ovaries* distinct. *Fruit* baccate, finally juiceless. *Seeds* albuminous, with the embryo in the axis.—*Rhizoma* jointed. *Leaves* ensiform, embracing each other in the bud.

*** A single sword-leaved sedge-like plant, *Acorus Calamus*, inhabiting the sides of rivers and meadows, represents this order in Europe, which is very nearly the same as Araceæ, but the ovaries are distinct and surrounded by scales.

Fig. CCXLV.—Luzula campestris and a flower, the latter much magnified

JUNCAGINACEÆ—ARROW-GRASSES.

ESSENTIAL CHARACTER.—*Sepals* and *petals* both herbaceous, rarely absent. *Stamens* 6. *Ovaries* 3 or 6, superior, cohering firmly; *ovules* 1 or 2, approximated at their base, erect. *Fruit* dry, 1- or 2-seeded. *Seeds* erect; *albumen* wanting; *embryo* having the same direction as the seed, with a lateral cleft for the emission of the plumule.—*Herbaceous* bog plants. *Leaves* ensiform, with parallel veins. *Flowers* in spikes or racemes, inconspicuous.

*** *Triglochin*, the only common genus of this order, is a little grassy plant, having one species growing in salt, and the other in fresh, water marshes and meadows. The order differs from Alismaceæ in having the petals no larger than the sepals, and the ovaries consolidated; and from Naiadaceæ in having erect ovules.

PISTIACEÆ—LEMNADS.

ESSENTIAL CHARACTER.—*Flowers* 2, naked, enclosed in a spathe. *Male*: *Stamens* definite. *Female*. *Ovary* 1-celled, with 1 or more erect *ovules*; *style* short; *stigma* simple. *Fruit* membranous or capsular, not opening, 1- or more-seeded.

*** *Duckweed* (*Lemna*) is the lowest known form of Phænogamous vegetation. It consists of lenticular floating fronds composed of stem and leaf mixed together, and bearing the flowers in slits in the edge.

CHAPTER IX.

OF CRYPTOGAMS, OR ACROGENS.

THESE are readily known by their not bearing flowers, on which account they are often called FLOWERLESS. They exhibit very different degrees of organisation; the highest or most complete, have both stems and leaves, and even a peculiar sort of wood; the lowest, or most incomplete, nothing but slender, simple, jointed threads, or even powdery matter; and the intermediate conditions are a mixture of stem and leaf in thin expansions, called a *thallus*.

Acrogens are necessarily classified upon different principles from Exogens and Endogens. The last divisions of M. De Candolle are:—

Subclass 1. *Ætheogams.* Plants furnished with air vessels and stomates or air pores.

Subclass 2. *Amphigams.* Plants having neither air vessels nor stomates.

The principal natural orders belonging to these subclasses are:—

Subclass 1. *Ætheogams.*	Subclass 2. *Amphigams.*
Filices.	Characeæ.
Lycopodiaceæ.	Musci.
Equisetaceæ.	Lichenes.
Marchantiaceæ.	Fungi.
Jungermanniaceæ.	Algæ.

But as the distinctions of these subclasses are only to be made out by those acquainted with vegetable anatomy, the young student requires some other method of arrangement; and that first proposed by M. De Candolle is preferable.

That botanist originally divided Acrogens into those which produce distinct leaves, and those which have no distinction between leaf and stem; the first he called *Foliaceæ*, or leafy, and the second *Aphyllæ*, or leafless.

The orders above mentioned are thus disposed according to their divisions:

I. *Foliaceæ*.—Equisetaceæ; Filices; Musci; Jungermanniaceæ.

II. *Aphyllæ*.—Marchantiaceæ; Lichenes; Fungi; Characeæ; Algæ.

It is not necessary that the early student should occupy himself with these orders, further than to gain a general knowledge of the manner in which they differ from each other. They may be briefly distinguished thus:—

A. FOLIACEÆ.

a. Leaves veiny *Filices.*
b. Leaves simple, without visible veins.
  α. Imbricated
    1. Fructification in axillary, 2-valved spore cases *Lycopodiaceæ.*
    2. Fructification in calyptrate, indehiscent spore cases *Musci.*
    3. Fructification in naked, 4-valved spore cases *Jungermanniaceæ.*
  β Arranged in toothed sheaths. *Equisetaceæ.*

B. APHYLLÆ.

a. Reproductive organs mixed with elaters *Marchantiaceæ.*
b. Reproductive organs without elaters.
  α. Consisting of external shields placed upon a visible thallus *Lichenes.*
  β. Consisting of spiral nucules *Characeæ.*
  γ. Consisting of fleshy heads without a visible thallus *Fungi.*
  δ. Consisting of threads or membranes floating in water *Algæ.*

EQUISETACEÆ.—HORSETAILS.

ESSENTIAL CHARACTER.—A distinct *stem*, furrowed, hollow, and branched in a verticillate manner. Leaves in the form of toothed sheaths. *Reproductive organs* in cones, and consisting of a spore surrounded by clavate filaments twisted spirally.

Fig. CCXLVI.

EQUISETUM.

1. E *fluviatile* (*Water Horsetail*). Fertile stems simple, with large loose sheaths; sterile much branched, with the teeth of the sheaths small and subulate. ——— *Ditches and ponds.* The largest of all our species; its barren stems being 3 or 4 feet high.

2. E. *arvense.* Fertile and sterile stems alike, with from 16 to 18 furrows, and with erect nearly simple branches. Teeth of the sheaths short and rigid. ——— *Watery places and ditches.* The flowering stems appear in April; the barren stems at a later period.

3. E. *hyemale.* Stems throwing up simple branches only from the base, rough, furrowed. Sheaths with about 14 very small blunt often deciduous teeth (black at the extremity). Cones terminal. ——— *Boggy woods.* Cones appear in July and August. This plant forms the Dutch rushes, imported largely from Holland for polishing hard woods, ivory, brass, &c. It, like all the horsetails, owes this quality to its skin being composed to a large extent of flint in a comminuted state.

g. CCXLVI.—Equisetum arvense. 1. A peltate disk seen from the side.

FILICES—FERNS.

ESSENTIAL CHARACTER.—A distinct *stem* and *leaves*; the latter usually divided into numerous pieces, marked with forking veins, and circinate when they first unfold, often called *fronds*, but not in any way different from the leaves of other plants. *Reproductive organs*, *spore-cases*, or *thecæ*, containing angular spores; variously dehiscent, collected in lines or patches called *sori*, and often covered by a membrane or *indusium*; placed either on the back of the leaves or within the edge, or collected upon contracted and deformed leaves. The thecæ usually belted by an elastic ring, which is either perpendicular, horizontal, or terminal.

NEPHRODIUM.

Sori on the back of the leaves, covered with a kidney-shaped indusium.

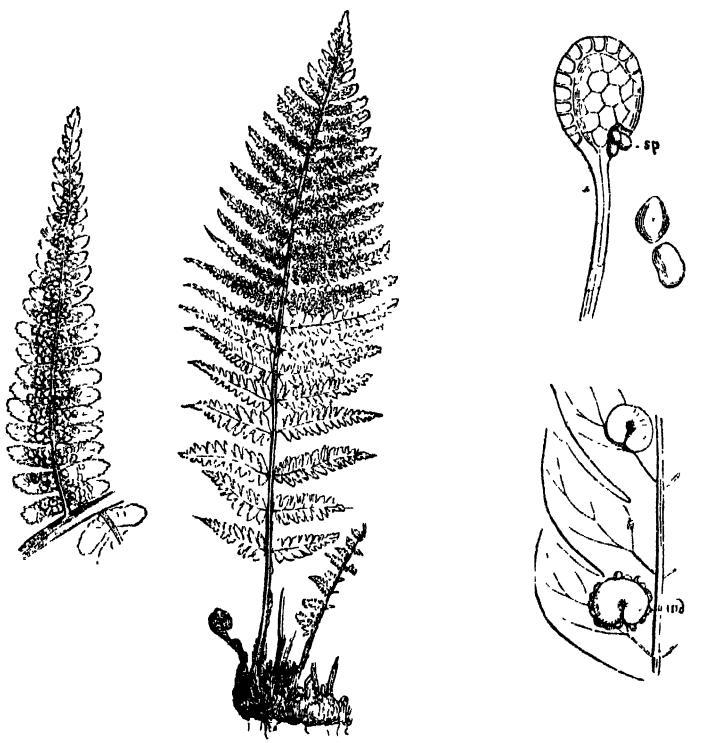


Fig. CCXLVII.

1. N. *Filix mas* (*Male fern*). Leaves bipinnate. Leaflets oblong, obtuse, serrated. Sori near the midrib. Leafstalk and rachis covered with ramenta.——— *Woods and shady banks.* Also called Lastrea and Aspidium Filix mas.

PTERIS.

Sori on the margin of the leaf, on the under side, uninterrupted, linear, covered by the inflexed margin.

Fig. CCXLVII.—Nephrodium Filix mas. 1. pinnules and a pair of sori; 2. spore case; *an.* annulus, or ring; *sp.* spores coming out.

1. P. *aquilina* (*Common Brake*). Leaves tripartite; their principal divisions bipinnate; pinnules linear-lanceolate, the upper undivided, the lower pinnatifid, with oblong, obtuse segments.——*Woods and heaths.*

SCOLOPENDRIUM.

Sori linear, transverse, with a narrow indusium arising from each side and meeting in the middle.

S. *vulgare* (*Hart's tongue*). Leaves simple, oblong, cordate, with a ramentaceous stalk.——*Wells, damp rocks, &c.*

ADIANTUM.

Thecæ with a vertical ring; hidden beneath rounded, reflexed, marginal, distinct indusia.

1. A. *Capillus Veneris* (*Maiden-hair*). Leaves doubly compound; leaflets alternate, wedge-shaped, on capillary stalks. Indusia oblong.——*Moist rocks and walls.* Foliage very thin, light green. The rhizome boiled in syrup forms *Capillaire.*

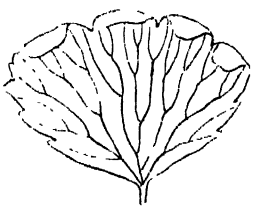


Fig. CCXLVII. *b.*

OSMUNDA.

Thecæ clustered on the margin of a transformed leaf, with an obscure ring, and opening by two regular valves.

1. O. *regalis* (*Osmund Royal* or *Flowering Fern*). Leaves bipinnate; leaflets oblong, nearly entire, auricled; Thecíferous divisions bipinnate, occupying the upper end.——*Marshes.* A very striking plant, from 6 to 12 feet high when full grown, with brown panicles

LYCOPODIACEÆ—LYCOPODS, OR CLUBMOSSES.

ESSENTIAL CHARACTER.—Moss-like plants, with dichotomous creeping or erect *stems* covered by imbricated scale-shaped veinless *leaves*. *Thecæ* axillary, often on contracted terminal portions of the branches, which resemble attenuated cones or spikes; 2-valved, sessile, concealed by their scales, and discharging minute powdery matter, or spores.

Fig. CCXLVII. *c.*

LYCOPODIUM.

1. L. *clavatum* (*Clubmoss, Snakemoss*). Spikes in pairs, cylindrical, stalked: their scales ovate-acuminate, eroded, toothed. Stem creeping; fertile branches ascending. Leaves hair-pointed, incurved.——*Hilly moors and damp alpine pastures.* The powdery spores inflammable, and used for fireworks.

2. L. *inundatum*. Spikes terminal, sessile, leafy, solitary. Stem short creeping. Branches simple, few. Leaves linear, scattered, acute, curved upwards.——*Wet heaths.*

3. L. *Selago*. Thecæ not in spikes, but axillary. Stems fastigiate. Leaves in rows, acuminate, entire, stiff.——*Heaths and mountain moors.*

Fig CCXLVII *b.*—Leaflet of Adiantum Capillus Veneris, magnified.
Fig. CCXLVII. *c.*—A fertile branch of Lycopodium clavatum.

BRYACEÆ—URNMOSSES.

ESSENTIAL CHARACTER.—A distinct *stem*, covered with simple imbricated veinless *leaves*. *Reproductive organs* contained in indehiscent sporangia or spore cases, closed with an operculum, and covered with a calyptra. Mouth of the *sporangia* usually closed by teeth.

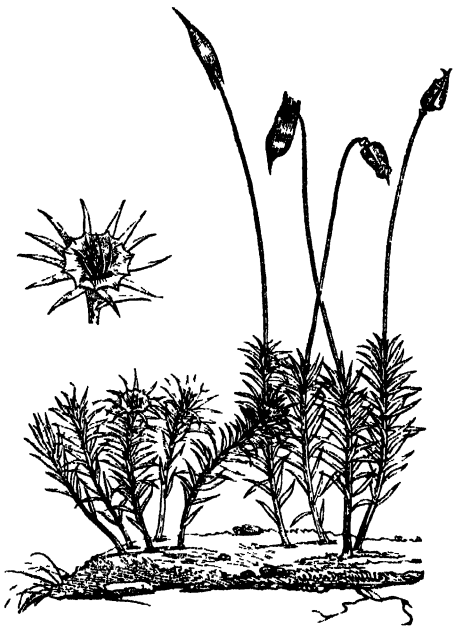


Fig. CCXLVIII.

Fig. CCXLVIII. *b*.

SPHAGNUM.

Sporangium on a soft stalk. Calyptra torn irregularly. Mouth of the sporangium naked. Operculum deciduous.

1. S. *obtusifolium*. Branches tumid. Leaves ovate, obtuse.——*Bogs and swampy places*. This is a spongy white-leaved moss, very retentive of moisture, and much used by Gardeners.

TORTULA.

Mouth of the sporangium simple, composed of 32 teeth, twisted spirally, and more or less united at their base.

1. T. *muralis*. Stem short, leaves spreading, narrow, oblong, recurved at the edge, the midrib extended into a hairlike point. Sporangium oblong-cylindrical. Operculum conical, acuminate.——*Walls*.

Sporangium pyriform ; its mouth double ; the outer of 16 compact teeth, the inner of as many ciliæ.

1. F. *hygrometrica*. Leaves concave, ovate, apiculated, entire, with the rib projecting beyond their point. Stalk of sporangium curved, flexuose. —*Walls, woods, and heaths*.

POLYTRICHUM.

Calyptra dimidiate, hairy. Mouth of the sporangium consisting of 32 or 64 equidistant teeth, united at the extremity by a horizontal membrane.

1. P. *commune* (*Common Hairmoss*). Stems long. Leaves spreading, linear subulate ; their edges flat, serrulate as well as the points of the keels. Sporecase oblong, quadrangular, with an evident apophysis.————*Heaths*, very common.

Fig. CCXLVIII.—Polytrichum commune. Fgi. CCXLVIII. *b*.—Sphagnum obtusifolium.

JUNGERMANNIACEÆ—SCALEMOSSES.

ESSENTIAL CHARACTER.—A distinct *stem*, covered with scale-like leaves. *Sporangium* without calyptra and operculum, and splitting into 4 valves, within which are numerous elaters or spiral threads, and spores.

*** These are moss-like plants, occurring in damp places, and on the bark of trees in shady woods. They are readily known by their soft cellular texture, and by the 4 valves of their spore cases.

MARCHANTIACEÆ—LIVERWORTS.

ESSENTIAL CHARACTER.—*Stem* and *leaves* united into a broad, green, lobed thallus, spreading upon the ground. *Reproductive organs* usually on stalked peltate receptacles, and of two or three different kinds, none of which are dehiscent sporangia.

MARCHANTIA.

Receptacles stalked, peltate; having on the under side short-stalked pendulous sporangia, filled with spores and spiral elastic fibres (*elaters*). Buds lenticular, in cup-shaped disks. Staminidia embedded in a flat fleshy disk.

1. M. *polymorpha*. Receptacle divided at the margin into 10 narrow segments. Disks containing staminidia, stalked.———*Moist shady places*. Overrunning the earth of neglected gardens and garden pots.

LICHENES—LICHENS.

ESSENTIAL CHARACTER.—Plants growing in air, not in water, and not forming a *mycelium* or *spawn*. *Leaves* and *stem* combined into a common mass called a *thallus*; which is horizontal and lobed, or erect and branched, often crustaceous, and never symmetrical. *Reproductive bodies* or *spores* in tubes called *asci*, which are buried within the horny substance of superficial *disks*, or *shields*, called *apothecia*.

PARMELIA.

Thallus leafy, membranous, or coriaceous, spreading, fibrous beneath. Shields orbicular, beneath formed of the thallus, fixed only by a central point; disk concave, bordered by the inflexed thallus.

1. P. *parietina* (*Yellow Pale-Lichen*) Thallus orbicular, bright yellow, the lobes radiating, rounded, crenate, and crisped, granular in the centre. Shields deep orange, concave, with an entire border.———*Pales, trees, &c.* Extremely common. A bitter plant, said to be a febrifuge.

2. P. *tiliacea*. Thallus orbicular, membranous, pale glaucous grey, rather mealy, lobed and sinuated; shaggy and brownish black beneath. Shields brown, with an incurved entire or crenate border.———*Trees in the S. of England.*

Fig. CCXLIX.

Fig. CCXLIX.—Parmelia tiliacea. 1. A shield with a portion of the thallus.

LECANORA.

Thallus crustaceous, uniform, level. Shields orbicular, thick, sessile; the disk plano-convex; the border thickish, formed of the thallus, and of the same colour.

1. L. *tartarea* (*Cudbear*). Thallus thick, granular and tartareous, greyish-white. Shields scattered; the disk convex, yellow-brown inclining to flesh-colour; the border thick, turned in, becoming wavy.———*Rocks in alpine countries.* Furnishes a purple dye.

ROCCELLA.

Thallus between leathery and cartilaginous, ascending, branched. Shields round, with an elevated border, black within.

1. R. *tinctoria* (*Orchall*). Thallus rounded, branched, greyish-brown, with numerous powdery warts.———*Rocks on the sea coast.* Yields a rich purple dye.

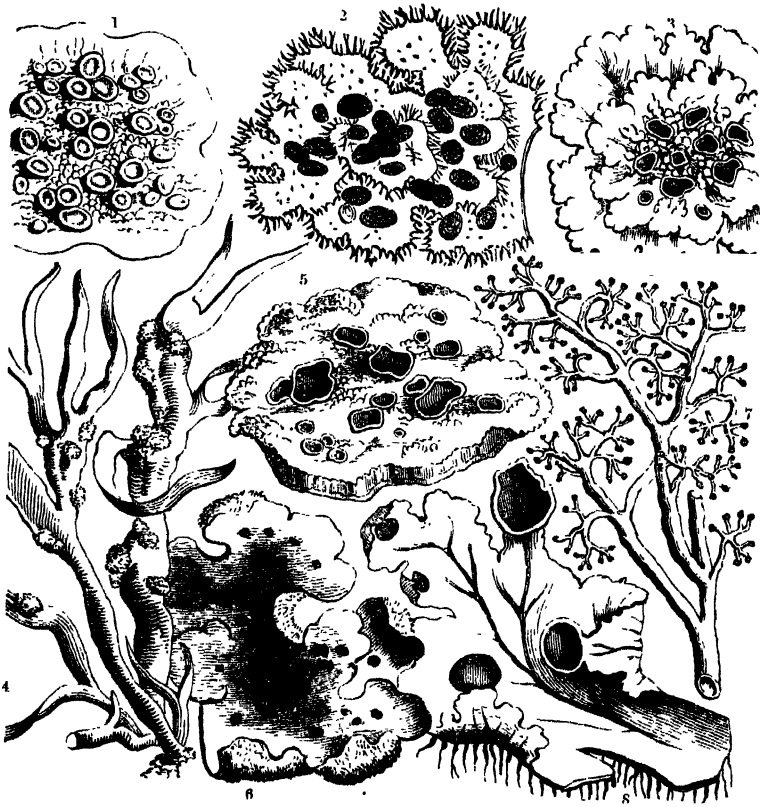


Fig. CCXLIX *b*

Thallus shrubby, round, branched, fistular, erect. Disks convex, capitate, without a border.

1. S. *pyxidatus* (*Common Cup-Lichen*). Thallus leafy, mealy; the lobes crisp, ascending. Shields linear.———*Heaths.* Very common. The crimson warts or shields on the edge of the gray mealy cups of this plant render it impossible not to recognise it.

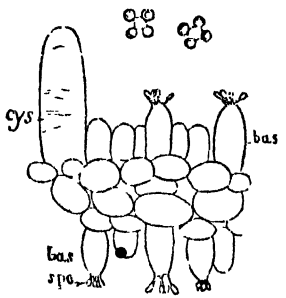
Fig. CCXLIX. *b*.—Figures of various Lichens. 1. Lecanora parella; 2. Gyrophora proboscidea, or Tripe de roche; 3. Parmelia parietina; 4. Roccella fuciformis, a kind of Orchall; 5. Lecanora tartarea, or Cudbear; 6. Peltidea aphthosa; 7. Cenomyce rangiferina, or Reindeer "Moss;" 8. Peltidea canina

FUNGI—FUNGALS.

ESSENTIAL CHARACTER.—*Aerial* plants. *Leaves* and *stem* none, except an under-ground filamentous thallus or spawn, which is often apparently absent. *Reproductive organs* simple, either concealed in a large fleshy mass of cellular substance, or naked.

AGARICUS.

Fructification a cap, divided by lamellæ on the under side. Spores placed in fours on a common stalk, growing from the face of the lamellæ.



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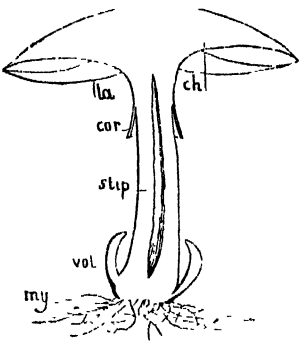


1. A. *campestris* (*Mushroom*). Cap fleshy, dry, somewhat scaly or silky. Lamellæ pink, free, at length brown. Stipe solid, furnished with a ring, white. ———*Pastures.* Much valued for its delicacy as an article of food and in preparing the sauce called Ketchup.

2. A. *comatus.* Cap somewhat fleshy, scaly, white. Lamellæ white, thin, brown purple. Stipe somewhat bulbous. Ring movable.——— *Waste places.* A very common toadstool, deliquescing soon after arriving at maturity.

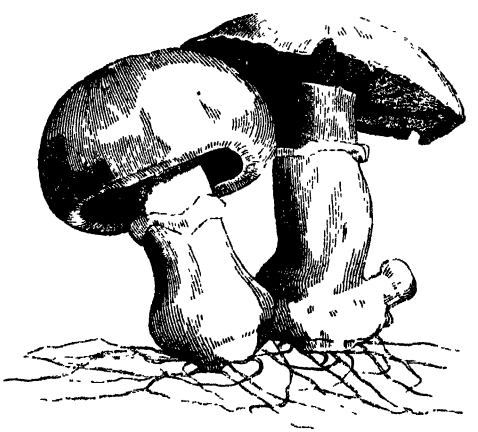


Fig CCL.

BOLETUS.

Fructification a cap, pierced by cylindrical separable tubes. Spores arranged in fours, on a common stalk, inside the tubes.

1. B. *lucidus.* Cap pulvinate, somewhat downy, olive-coloured Tubes nearly free, round, yellow, red at the orifice. Stipe thick, more or less marked with crimson. ——*Woods.*

TUBER.

Fructification a rough, roundish, fleshy mass, marbled with veins internally, on which are stationed the stalked sporecases, containing one or two spores each.

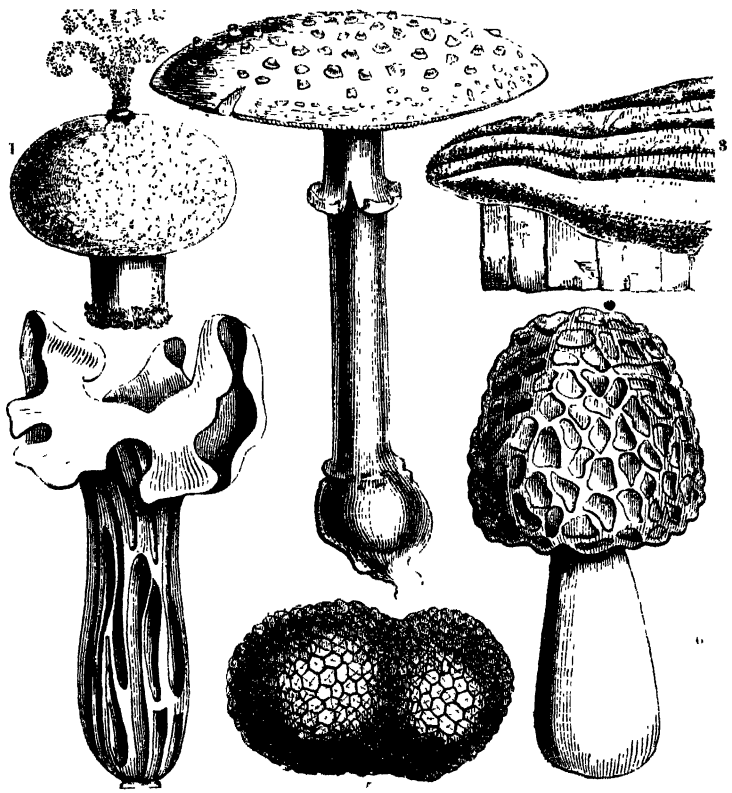
1. T. *cibarium* (*Truffle*). Subterranean, warted, black.———*Beech woods.* Highly esteemed as food.

Fig. CCL.—Agaricus campestris. 1. plan of its structure: *la.* hymenium or gills; *ch.* pileus or cap; *cor* ring; *vol.* volva; *stip* stipes; *my.* mycellum or spawn; 2. the reproductive apparatus: *cys* cystidia, *bas.* basidia; *spo.* spores.

AMANITA.

Differs from Agaricus in having a double *veil;* the outer covering the whole plant when young.

1. A. *muscaria* (*The Fly Agaric*). Cap broad, convex, rich orange scarlet, streaked at the edge, and covered with angular warts. Lamellæ, or gills, white. Stem nearly solid, bulbous.———*Fir and Birch woods.* A very dangerous poison; an infusion used to kill flies.



LYCOPERDON.

Rind (Peridium) membranous, with an adnate nearly permanent bark, bursting irregularly and discharging a cloud of powdery spores.

1. L. *giganteum.* Rind very brittle, bursting in irregular spaces, at length rending open.———*Fields and plantations.* White; often 2 or 3 feet in circumference. When dry and burnt its smoke stupifies bees.

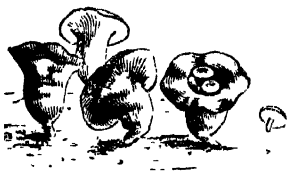
2. L. *gemmatum* (*Common Puff-ball*). Rind membranous, persistent, with numerous little prickly warts; bursting at the summit. Powder olive-green.——— *Pastures everywhere.* White, becoming brown.

Fig. CCL *b*.—Figures of various Fungi. 1 Lycoperdon gemmatum, the Puff-ball; 2. Amanita muscaria; 3. Polyporus igniarius, on wood; 4. Helvella crispa, the Mitre Mushroom; 5. Tuber cibarium, the Truffle; 6. Morchella esculenta, the Morell.

NIDULARIA.

Cup-shaped, leathery bodies. Spore-cases lenticular, stalked, fleshy, furnished with an elastic stalk.

1. N. *campanulata* (*Common Bird's-nest Peziza*). Bell-shaped, ashy-brown, even, within lead-coloured and shining.——*On the ground, among stubble and elsewhere.*



HELVELLA.

Cap deflexed, lobed; Gills (hymenium) none, but a smooth even surface.

1. H. *crispa* (*The Mitre Mushroom*). Cap whitish or flesh-coloured, turned down irregularly, lobed, crisp, pallid. Stem with deep furrow-like irregular excavations, fistular.———*Woods, in the autumn.* Eatable.

MORCHELLA.

Cup uniform, convex; Gills none, but a ribbed, irregularly excavated hymenium.

1. M. *esculenta* (*The Morell*). Cap conical, dull dirty yellow, ovate or globose, united to the stalk at its base, with the excavations forming distinct cells.— ——*Woods, orchards, &c. in summer.* Esteemed as an esculent.

Fig. CCL *d*.

Fig. CCL *c*.—Nidularia campanulata.

Fig. CCL. *d*.—Agaricus orcades, or Champigny; the Fairy-ring Mushroom, wholesome, fragrant, and when dried and powdered, used largely in sauces.

TUBERCULARIA.

Spores simple, collected into a roundish, erumpent, distinct disk.

1. T. *vulgaris*. Red, erumpent, globular, naked at the edge.——*Dead sticks*, which it frequently covers with its scarlet pimples.

PUCCINIA.

Spore cases with 1 or 2 partitions, stalked, collected into tubercles, bursting from under the skin of plants.

1. P. *Graminis* (*Mildew*). Spots pale, spreading, in linear confluent streaks. Spore-cases becoming black.——*Stems of corn.*

CHARACEÆ.—CHARAS.

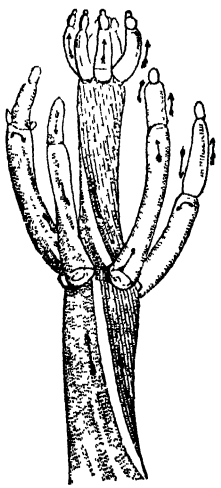


Fig. CCLI.

Essential Character.—*Aquatic* plants with *leaves* and *stem* combined into articulated, hollow, verticillate branches, which consist either of simple tubes, or of a layer of tubes external to the first tube; in the latter case the branches are striated, in the former smooth. *Reproductive organs* consisting of globules of a reddish colour, and of spirally twisted nucules.

*** These plants, found everywhere in stagnant water, are chiefly interesting because they exhibit in a distinct manner the currents of sap in the interior of their tubes. The arrows in the annexed figure show in what directions such currents set.

CHARA.

Branches compound, striated, brittle.

1. C. *vulgaris*. Smooth, opaque, brittle, not incrusted, obscurely striated. Branches slender, subulate, much longer than the organs of reproduction.—*Ditches and stagnant pools.*

NITELLA.

Branches simple, smooth, flexible.

1. N. *flexilis*. Long, smooth, flaccid, pellucid, very dichotomous. Branches simple or divided, obtuse. Reproductive organs almost naked ——*Ditches and lakes.*

ALGÆ—ALGALS.

Essential Character.—*Submersed* plants, with the *stem* and *leaves* combined into lobed fronds, or reduced to capillary divisions. *Reproductive organs* either special and external to the frond, or a mere dissolution of the interior.

*** The green slimy matter of ponds and ditches, with seaweeds, belong to this order; the nature of which cannot be examined without the assistance of a good microscope.

Fig. CCLI.—Nitella flexilis, much magnified.

CHAPTER X.

PHYSIOLOGICAL APHORISMS;

OR, THE RUDIMENTS OF PRACTICAL PHYSIOLOGY.

IN the following paragraphs the most important facts of Vegetable Physiology are reduced to a series of simple propositions which can be easily committed to memory by the young. The phenomena which they describe constitute the foundation of the operations of the husbandman, and ought to be familiar to all well-informed persons. It has happened, indeed, that many rules of practice in Gardening, Farming, and Foresting have been discovered by chance, and that others continue to be the result of accident; but it cannot be doubted that these discoveries or improvements would have been long anticipated, had the exact nature of the laws from which they necessarily result been comprehended. It is also certain that many common operations would be greatly improved were the facts of vegetable life more generally understood. There can be little interest in watching the success of operations, of which the reasons are unknown, compared with that which is felt when the phænomena attendant upon practice are clearly comprehended, so that results can be anticipated, or the causes of success or failure be appreciated. It must also be manifest, that, however skilful any person may become by mere force of habit, and by following certain prescribed rules which experience has, or seems to have, sanctioned; yet that much more success is to be expected, when he acts upon fixed principles, the soundness of which has been ascertained, instead of following mere empirical prescriptions, which are very apt to mislead.

SECTIONS.

§ I. THE GENERAL NATURE OF PLANTS.

1. The vegetable kingdom is composed of living beings, destitute of sensation, with no power of moving spontaneously from place to place, and called plants.

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Allan's Anti Fat		per bottle	6	0	0
Allen and Hanbury's Nitrate of Amyl Capsules, *for inhalation to relieve head ache*		per box	2	0	0
Allcock's Porous Plasters		each	1	0	0
Benbow's Dog Soap		per tablet	0	8	0
Do. Dog Mixture		bottle	2	0	0
Bright's Phosphodyne		do.	7	8	0
Brou's Injection		do.	3	0	0
Browne's Chlorodyne		bottle at Rs. 1 & 2 each.			
Bravais' Dialysed Iron		,, do.	3	0	0
Bondault's Pepsine, *useful in Dyspepsia*		,, do.	4	0	0
Brown's Restorative Assimulant, *Coughs, &c.*		,, do.	10	0	0
Clarke's Blood Mixture		,, do.	1	12	0
Do. B 11 Pills.		,, do.	3	8	0
Do. Miraculous Salve		,, pot	1	4	0
Camphorated Chalk Dentifrice		,, box	1	0	0
Cleavers' Terebene Soap	Bars 8 annas	,, do.	1	0	0
Calverts' Carbolic do.		,, Tablet	0	4	0
Cockle's Antibilious Pills		,, box	1	0	0
Cooper's (Sir Astley's) Fluid extract of Sarsaparilla		,, bottle	2	0	0
Condy's Pick-up Powder *highly recommended*		,, do.	1	0	0
Compound Essence of Opium and Camphor *for Diarrhœa, Cholera, Flatulence*, &c.,		,, do.	1	0	0
Copaiba Capsules		,, do.	1	0	0
Davis' Home Relief		,, do.	2	0	0
DeJongh's Cod Liver Oil		,, do.	1	8	0
Delcroix's Castor Oil Pomade		,, pot	1	8	0
Do. Marrow Oil		,, bottle	0	8	0
Do. Lavender water		,, do.	2	0	0
DeRoos' Gutta Vita		,, do.	Rs. 9 to 25 each.		
Do. Renal Pills		,, box	1	0	0
D'Roos Vegetable Pills		,, do.	1	0	0
Dinneford's Fluid Magnesia		,, bottle	1	0	0

				RS.	A.	P.
Eau de Cologne (*John Maria Farina*)	per	bottle	...	0	10	0
Do. No. 4	,,	do.	...	1	0	0
Eno's Fruit Salt	,,	do.	...	1	12	0
Do. Pills	,,	box	...	1	0	0
Extract of Meat (*Liebegs*)	,,	pot Rs. 1 & 1-8 each.				
Eno's Combination of Phosphorised Iron, Quinine, &c.			...	3	0	0
Eucharesma *(a splendid application for the Hair an agreeable Hair Wash)*		per bottle	...	3	0	0
Fisher & Co's. Carbolic Disinfecting Powder—*Every household should have some*		per lb.	...	0	3	0
Do. Fever Tincture, *cures Fevers of all description*	per	bottle	...	1	8	0
Do. Cough Specific, *cures all Coughs, Bronchitis, Consumption in its early stages*		per bot	...	0	12	0
Do. Marking Ink	,,	bottle	...	0	12	0
Do. Hair Oil	,,		...	0	12	0
Ferris & Co.'s Thymol Soap, *ante-septic and Dis-infectant*	,,	box	...	1	4	0
Fenning's Cooling Powder	,,	do.	...	1	0	0
Do. Fever Cure or Stomach Mixture	,,	bottle	...	1	4	0
Floriline for the Teeth and Gums	,,	do.	...	2	0	0
Freeman's Chlorodyne	,,	do.	...	0	12	0
Fuller's Earth (Mathews)	,,	box	...	1	8	0
Grimault's Cigarettes *for Asthma*	,,	do.	..	1	0	0
Do. Matico Capsules	,,	do.	...	2	8	0
Do. do. Injection	,,	bottle	...	2	8	0
Do. Syrup Hypophosphate of Lime	,,	do.	..	2	0	0
Do. do. do. Horse Radish	,,	do.	...	2	0	0
Godfrey's Extract of Elder Flowers, *to beautify the complexion*	,,	do.	...	2	8	0
Hewlett's Liquor Copaiba and Cubebs	,,	oz.	...	0	10	0
Henry's Thilum (*appointed Agents*)	,,	pot.	...	1	4	0
Holloway's Ointment and Pills	14 annas to 2-8 per pot or box.					
Horner's Cod Liver Oil		per bottle	...	0	12	0
Infant's Food, (Nestle's)	,,	Tin	...	1	8	0
Ingluvin—*the remedy for indigestion, Dyspepsia, sick Stomach, &c.*	,,	bottle	...	5	0	0
Jamaica Pomade	,,	pot	...	1	0	0
James' Blister for Horses	,,	,,	...	1	8	0
Jaynes Expectorant	,,	bottle	...	3	4	0

			Rs.	A.	P.
Johnson's Soothing Syrup	per	bottle ...	2	4	0
Keating Cough Lozenges	,,	do. ...	1	0	0
Do. Bon Bons or Worm Tablets	,,	do. ...	1	0	0
Do. Insect Destroying Powder	,,	do. ..	1	4	0
Kirby's Phosphorous Pills	per	dozen .	1	8	0
King's Dandelion Pills	,.	box ...	1	0	0
Lactopeptine, *for indigestion, and weak stomachs*	,,	bottle ...	4	0	0
Lalor's Phosphodyne	,,	do. ...	4	0	0
Do. Blood Purifying Pills	,,	box .	1	4	0
Do. Ointment	,.	do. ...	1	4	0
Lamplough's Pyretic Saline	,,	bottle	2	0	0
LeClerc's Nervo-Tonic Pills	,,	box ...	2	8	0
Leath and Ross' Neuraline, *for pains in the Face, &c.*	,,	do. .	1	0	0
Locock's Pulmonic Wafers	,,	do. ...	1	4	0
Lazarus' Essence of Chirotta for Fever &c.	per bottle Rs. 4-cash—Rs. 4-8 credit.				
McDougall's Disinfecting Fluid	per	bottle ...	1	0	0
Morrison's Pills No. 1 and 2	,,	box ...	0	12	0
Do. Ointment	,,	pot ...	1	0	0
Mother Seigel's Curative Syrup	per bottle Rs. 1-12-0 & 3-12-0 each *cash.*				
Do. do. Operating Pills	per	box ...	1	0	0
Macassar Oil, for the Hair	,,	bottle ..	2	8	0
Norton's Camomile Pills	,,	,, ...	1	0	0
Odonto—the best Dentrifrice recommended	,,	box ...	1	0	0
Odynephatine, *the cure for Rheumatism, Lumbago, &c.*	,,	bottle ...	1	4	0
Pears' Coal Tar Soap	,,	tablet ...	0	8	0
Do. Lime Juice and Glycerine, *for dandriff*	,,	bot. Ans. 8 & 1 each.			
Do. Toilet Soap, Almond, Honey and Almond, Elder Flower, White Almond and a great variety to choose from	per box of 3 Tablets ..		1	0	0
Do. Rose Soap large Tablets		each ..	0	8	0
Do. Elder flower Soap in Bars		do. ...	1	0	0
Perry Davis' Pain Killer	per	bottle ...	1	0	0
Powell's Balsam of Aniseed, *for coughs*	,,	Rs. 2 &	1	0	0
Price's Toilet Vinegar	,,	.	1	0	0
Do. Bloom of Roses	,,	..	2	0	0
Do. Lavender Water	,,	...	1	0	0
Price's Golden Oil	,,	...	1	0	0
Perry and Co's celebrated Balm of Syriacum	,,	...	5	0	0

2. Plants are organised bodies, consisting of masses of tissue through which fluids or gaseous matter readily pass.

3. Plants are also endued with a principle of life (*vitality*) analogous to that of animals, although different in the way in which it is manifested. Thus they may be poisoned by laudanum or arsenic, may be deprived of sensibility by chloroform, may be fattened by abundant food, or starved by the absence of it.

4. Vegetable tissue consists either of minute bladders, or of tubes adhering by their contiguous surfaces, and leaving intermediate passages where they do not touch.

5. Tissue is called *Cellular* when it is composed of minute bladders.

6. When newly formed, it absorbs with much force whatever gaseous or fluid matter comes in contact with it. As it grows old its power of absorption diminishes.

7. Cellular tissue, otherwise called Parenchyma, constitutes the soft and brittle parts of plants; such as pith, pulp, the spaces between the veins of leaves, the principal part of the petals, and the like.

8. Succulent plants are such as have an excessive development of cellular tissue.

9. It may be considered the most essential kind of tissue, because, while no plants exist without it, many are composed of nothing else.

10. Tissue is called *Woody Fibre* when it is composed of slender tubes placed side by side.

11. Woody Fibre is what causes stiffness and tenacity in certain parts of plants; hence it is found in the veins of leaves, and in bark, and constitutes the principal part of wood.

12. *Vascular tissue* consists of tubes containing a spiral thread. It usually occurs mixed with fibrous tissue, and hence the mixture of the two is called *fibro-vascular*.

13. The most remarkable form of vascular tissue is the *spiral vessel*, which has the power of unrolling with elasticity when stretched. It is found in the veins of all leaves, and is to be seen easily by breaking and stretching gently the leafstalk of the strawberry plant.

14. *Cambium* is a viscid substance found between bark and wood in the spring and autumn. It is what causes bark to "run," and consists of very young tissue just beginning to be formed.

15. Cellular tissue performs the following offices:—

1. It conveys fluids in all directions;
2. It absorbs with rapidity;
3. It is the substance by means of which one part grows to another;
4. It is the part in which the secretions formed by plants are deposited. This may be seen by the rind of an orange, which is a mass of cellular tissue containing the oil secreted by that fruit.

16. The union of one portion of cellular tissue to another will take place at all times during the growing season.

17. If the cellular tissue of two parts of the same plant, or even of different plants, is bound together while it is young and tender, the two parts will grow together as firmly as if they had never been separate. This is called grafting and budding, and is shown by a branch of one kind of appletree being made to grow upon another.

18. But this artificial union will only occur when the cellular tissue belongs to the same species, or to two species of the same natural order.

Therefore what we read in Virgil's Georgics is not true. That

"*Steriles* Platani malos *gessere valentes.*—GEORGIC. ii. 70."

is a mere fiction, for the Platanus or Plane tree belongs to Urticaceæ, and the Malus, or Apple, to Rosaceæ.

19. Woody fibre conveys fluid in the direction of its length, gives stiffness and flexibility to the general system, and acts as a protection to spiral and other delicate vessels.

20. The parts of which Tissue is composed are simple, unbranched, and regular in figure; when elongated their two extremities are alike, and destitute of internal valves.

21. Tissue is, therefore, capable of conveying gaseous matter or fluids upwards or downwards equally well, consequently a current may be reversed in them without inconvenience: and hence plants will grow when inverted nearly as well as in their natural position.

§ II. THE FOOD OF PLANTS.

22. Plants live by suction, feeding upon water, certain kinds of gaseous matter, and such mineral substances as can be dissolved in water.

23. But they cannot feed at all unless they are exposed to a temperature above that of freezing.

24. Warmth is as necessary to them as food. This is the principal reason why heavy clay land becomes so much improved by deep drainage. The effect of that operation is to increase the warmth of the soil very considerably.

25. They find water and mineral substances in the earth. Gases they obtain either from the air or from water in which such gases are dissolved.

26. The principal kinds of mineral food are potash, soda, lime, flint, phosphorus, and sulphur.

27. The principal kinds of gaseous matter are carbonic acid and ammonia, both produced by bodies in a state of putrefaction.

28. Hence the decaying substances called manure, although offensive to our own senses, are of great importance to plants.

29. No soil contains an unlimited supply of food. Every crop takes something away and impoverishes the land. Therefore it is necessary to replace what is taken away by adding more;

30. Unless new soil is continually brought into contact with roots by diligent and effectual tillage.

§ 3. ROOT.

31. The root is the part that strikes into the earth when a seed grows, and which afterwards continues to lengthen beneath the soil.

32. It is also sometimes produced by the stem, as in Ivy, Vines, Laurels, &c.

33. The office of the root is to absorb food, and to fix the plant in the soil, or to some firm support.

34. The latter office is essential to the certain and regular performance of the former.

35. Roots do not feed equally by all parts of their surface, but chiefly by their young and newly formed extremities, called *Spongioles.*

36. A spongiole consists of very young cellular tissue. It is therefore one of the most delicate parts of plants, and the most easily injured.

37. Hence the preservation of the spongioles in an uninjured state is very important when a plant is removed from one place to another.

38. Whatever is known to produce a deleterious action upon leaves or stems, such as certain gases and poisons, will produce a much more fatal effect upon the spongioles.

39. These organs have no power of selecting their food, but suck up whatever the earth or air may contain, provided it is sufficiently fluid to pass through the sides of their tissue.

40. So that if roots are formed in a medium of an unsuitable nature, they cannot fail to introduce matter which will prove either injurious or fatal to life, according to its intensity; because the spongioles will absorb what is hurtful as well as that which is suitable.

41. This partially explains why trees suddenly become unhealthy, without any external apparent cause. Dryness or coldness of soil are other common causes.

42. Plants have the power of replacing spongioles by the formation of new ones; so that an individual is not destroyed by their loss.

43. But this power depends upon the co-operation of the atmosphere, very much upon warmth, and also upon the special vital powers of the species.

44. If the atmosphere is damp and the earth warm, spongioles will have time to form anew; but if the atmosphere is dry, or the earth too cold, a plant will perish before new spongioles can form.

45. For this reason plants, if growing, can be most securely transplanted in warm damp weather.

46. Although roots are generated underground, and sometimes at considerable depths, yet access to air is indispensable to the healthy execution of their functions. Hence if much earth is piled up above a healthy tree that tree soon sickens. While, on the other hand, if its roots find their way into a drain the tree grows better than ever.

§ 4. OF THE STEM.

47. The more erect a stem grows the more vigorous it is; and the more it deviates from this direction to a horizontal or pendulous position, the less is it vigorous.

48. Exogenous stems increase in diameter by the addition of new matter to the outside of the wood and the inside of the bark.

49. In such stems, the central portion, which is harder and darker than that at the circumference, is called *Heart wood;* while the exterior, which is softer and lighter, is called *Alburnum* or *Sap-wood.*

50. The inside of the bark of such stems is the *Liber.*

51. The Heart-wood was, when young, Alburnum, and afterwards changed its nature, by becoming the receptacle of certain secretions peculiar to the species.

52. Hence the greater durability of Heart-wood than of Sap-wood. While the latter is newly-formed empty tissue, almost as perishable as bark itself, the former is protected against destruction by the introduction of secretions that become solid matter, which is often insoluble in water, and never permeable to air.

53. The secretions by which Heart-wood is solidified are prepared in the leaves, whence they are sent downwards through the bark, and from the bark communicated to the central part of the stem.

54. The channels through which this communication takes place are called *Medullary Rays*, or *Silver Grain*.

55. Medullary rays are plates of cellular tissue, in a very compressed state, passing from the pith into the bark.

56. The wood itself is composed of tubes consisting of woody fibre and vascular tissue, imbedded longitudinally in cellular substance.

57. This cellular substance only developes horizontally; and it is to it that the peculiar character of different kinds of wood is chiefly due.

58. For this reason the wood of the stock of a grafted plant will never become like that of its scion.

59. In the spring and autumn a viscid substance is secreted between the wood and the liber, called *Cambium*.

60. This Cambium appears to be the matter out of which the cellular horizontal substance of the stem is organised.

61. The stem is not only the depository of the peculiar secretions of species, but is also the medium through which the sap flows in its passage from the roots into the leaves.

62. In Exogenous stems it certainly rises through the wood and descends through the bark.

63. Stems have the power of propagating an individual by means of their Leaf-buds.

§ 5. OF THE LEAF-BUDS.

64. Leaf-buds are rudiments of branches, enclosed within scales, which are imperfectly formed leaves.

65. All the leaf-buds upon the same branch are constitutionally and anatomically the same.

66. If regular they are formed at the axils of Leaves. What is called the *tillering* of cornplants is the result of their forced development, caused by destroying the end of the stem originally formed in a seedling plant.

67. They are capable of propagating the individual from which they originate.

68. They are nourished by the fluid lying in the pith, and adjacent tissue. They possess their most complete vigour when they are completely formed, or, as Gardeners say, are ripe.

69. Their vigour will be in proportion to their nourishment; and, consequently, when it is wished to procure a young shoot of unusual strength, all other shoots in the vicinity are prevented growing, so as to accumulate for one shoot only the whole of the food which would otherwise have been consumed by several.

70. When they disarticulate from the stem that bears them, they are called *bulbs*.

71. In some plants, a bud, when separated from its stem, will grow and form a new plant, if placed in circumstances favourable to the preservation of its vital powers.

72. But this property seems confined to plants having a firm, woody perennial stem.

73. Such buds, when detached from their parent, send roots downwards and a stem upwards.

74. But if the buds are not separated from the plant to which they belong, the matter they send downwards forms wood and liber, and the stems they send upwards become branches.

75. If no leaf-buds are called into action, there will be no addition of wood: and, consequently, the destruction or absence of leaf-buds is accompanied by the absence of wood; as is proved by a shoot, the upper buds of which are destroyed and the lower allowed to develop. The lower part of the shoot will increase in diameter; the upper will remain of its original dimensions. The quantity of wood, therefore, depends upon the quantity of leaf-buds that develop.

76. It is of the greatest importance to bear this in mind in pruning timber trees; for excessive pruning must necessarily be injurious to the quantity of produce.

77. A branch with two or more leaf-buds upon it is a *cutting*.

78. If a cutting be placed in circumstances fitted to the development of the leaf-buds, it will grow and become a new plant.

79. If this happens when the cutting is inserted in the earth, the new plant is said by gardeners *to be upon its own bottom*.

80. But if the cutting is applied to the dissevered end of another individual called *a stock*, the cellular tissue of the two unites, and a plant is said to *be grafted*; the cutting being then called *a scion*.

81. This union is only effected when the cellular substance, namely the bark, of the two, is made to come in contact.

82. A leaf-bud separated from the stem will also become a new individual, if its vital energy is sufficiently powerful.

83. And this, whether it is placed in earth, into which it roots like a cutting, or on a new individual to which it adheres and grows like a scion. In the former case it is called *an eye*, in the latter *a bud*.

84. Every leaf-bud has, therefore, its own distinct system of life, and of growth.

85. And as all the leaf-buds of an individual are exactly alike, it follows that a plant is a collection of a great number of distinct identical systems of life, and is consequently a compound individual.

86. Leaf-buds are generated in the axils of leaves, and it is there that they are always to be sought.

87. If they cannot be discovered by ocular inspection, it may nevertheless be always inferred with confidence that they exist in such situations, and may possibly be called from their dormant state into life.

88. Hence, wherever the scar of a leaf, or the remains of a leaf, can be discovered, there it is to be understood that the rudiments exist of a system of life which may be, by favourable circumstances, called into action.

89. Hence, all parts upon which leaves have ever grown may be made use of for purposes of propagation.

§ 6. OF THE LEAVES.

90. Leaves are expansions of bark, traversed by veins and enclosed in a skin or epiderm.

91. The veins consist of spiral vessels cased with woody fibre; they are connected by loose Parenchyma, which is full of cavities containing air.

92. Their cells are arranged so as to leave numerous open passages among them for the circulation of air.

93. Epiderm is formed of one or more layers of depressed cellular tissue filled with air.

94. Between many of the cells of the epiderm are placed apertures

called *stomates*, which have the power of opening and closing as circumstances may require.

95. It is by means of this apparatus that leaves absorb water and gaseous matter from the atmosphere.

96. It also enables them to elaborate the sap which they absorb from the alburnum, converting it into the secretions peculiar to each species of plant.

97. Their loose cavernous structure enables them to bring the greatest possible surface of their parenchyma into communication with the atmosphere.

98. Their epiderm is a non-conducting skin, which protects them from great variations in temperature, and through which vapour and gaseous matter pass readily.

99. Their stomates are pores, chiefly intended to facilitate evaporation; for which they are adapted by the power they possess of opening or closing as circumstances may require. Stomates are also intended for facilitating the rapid emission of air, when it is necessary that such a function should be performed.

100. All the secretions of plants being formed in the leaves, or at least prepared there, it follows that secretions cannot take place if leaves are destroyed; except in leafless plants in which the leaves are represented by green bark.

101. And as this secreting property depends upon specific vital powers called into action only when leaves are freely exposed to light and air, it also follows that the quantity of secretion will be in direct proportion to the quantity of leaves, or to their area, or to their free exposure to light and air.

102. This explains why plants constantly deprived of leaves die; why they languish when their leaves have not sufficient access to light and air; and why colour and taste and fertility are diminished in proportion as the leaves of plants are destroyed or diminished.

103. Timber, which is a natural secretion, produced by the agency of leaves, will in like manner be abundant or the contrary in proportion to the number of leaves, &c. (101). Crowding trees, or excessive pruning, have therefore a tendency to diminish the quantity of timber which a given tree is capable of forming.

§ 7. OF FLOWERS.

104. Flowers consist of two principal parts, viz. *Floral Envelopes* and *Sexes*.

105. Of these, the former constitute what is popularly considered the flower; although the latter are the only parts that are absolutely essential to it.

106. However different they may be in appearance from leaves, they are all formed of those organs in a more or less modified state, and altered in a greater or less degree by mutual adhesion. In other words, the parts called leaves or floral organs are all, when in a rudimentary state, of precisely the same nature; and become leaves or flowers according to the vital forces which act upon them after their first formation.

107. A Flower being, then, an axis surrounded by leaves, it is in reality a stunted branch; that is to say, a branch the growth of which is checked, and its power of elongation destroyed.

108. That flowers are stunted branches is proved, *firstly*, by all their parts, especially the most external, occasionally reverting to the state of

ordinary leaves ; *secondly*, by their parts being often transformed into each other ; and *thirdly*, by the whorls of flower-buds being dislocated and actually converted into branches whenever anything occurs to stimulate them excessively.

109. Their most essential distinctive character consists in the buds at the axils of their leaves being usually dormant, while those in the axils of ordinary leaves are usually active.

110. For this reason while Leaf-buds can be used for the purpose of propagation, flower-buds cannot usually be so employed.

111. Since there is in all plants a great difference in the development of leaf-buds, some growing readily into branches, others only unfolding their leaves without elongating, and many remaining altogether dormant, so it also follows that flower-buds may form upon plants of whatever age and in whatever state.

112. But to produce a general formation of flower-buds it is necessary that there should be some general predisposing constitutional cause independent of accidental circumstances.

113. This predisposing cause is the accumulation of sap in the state of what is termed organisable matter; that is to say, of a viscid elaborated secretion out of which new organs are generated.

114. Therefore whatever tends to retard the free flow of sap, and cause it to accumulate, will cause the production of flower-buds, or fertility.

115. And on the other hand, whatever tends to produce excessive vigour causes the dispersion of sap, or prevents its elaboration and causes sterility.

116. Transplantation with a partial destruction of roots, age, or high temperature accompanied by a dry atmosphere, training obliquely or in an inverted direction, a constant destruction of the extremities of young growing branches, will all cause an accumulation of secretions ; and consequently all such circumstances are favourable to the production of flowers.

117. But a richly manured soil, high temperature, with great atmospheric humidity, or an uninterrupted flow of sap, are all causes of excessive vigour, and are consequently unfavourable to the production of flowers.

118. There is a tendency in many flowers to enlarge, to alter their colours, or to change their appearance by a transformation and multiplication of their parts, whenever they have been raised from seeds for several generations, or domesticated ; as in Double roses, Double Anemones, &c.

119. The causes of this tendency are probably various, but being unknown, no certain rules for the production of varieties in flowers can be laid down, except by the aid of hybridising.

120. It often happens that a single branch produces flowers different from those produced on other branches. This is technically called a *sport*.

121. As every bud on that branch has the same specific vital principle, a bud taken from such a branch will produce an individual, the whole of whose branches will retain the character of the sport.

122. Consequently, by buds an accidental variety may be made permanent, if the plant that sports be of a perennial woody nature.

123. As flowers feed upon the organisable matter in their vicinity, the greater the abundance of this prepared food, the more perfect will be their development.

124. Or the fewer the flowers on a given branch the more food

they will severally have to nourish them, and the more perfect will they be.

125. The beauty of flowers will therefore be increased either by an abundant supply of such food, or by a diminution of their numbers (thinning,) or by both. The business of the pruner is to bring about these results.

126. The beauty of flowers depends upon their free exposure to light and air, because it consists in the richness of their colours, and their colours are greatly influenced by the action of those two agents.

127. Hence flowers produced in dark or shady confined situations are either imperfect, or destitute of their habitual size and beauty.

128. Double Flowers are those in which the stamens are transformed into petals; or in which the latter, or the sepals, are multiplied.

129. Although no certain rules for the production of Double Flowers can be laid down, yet it is probable that those flowers have the greatest tendency to become double, in which the sexes are habitually multiplied.

130. In plants with indefinite stamens or carpels Double Flowers are more frequent than in any others; Ex: Rose, Anemone.

131. It is therefore in such plants that Double Flowers are to be principally expected.

132. In proportion as the sexes of flowers habitually become few in number, do the instances of Double Flowers become rare.

133. Double Flowers are therefore least to be expected in plants with fewest stamens.

134. Whenever the component parts of a flower adhere by their edges, as in monophyllous calyxes, monopetalous corollas, and monadelphous, or di-, or poly-adelphous stamens, the tendency to an unnatural multiplication of parts seems checked.

135. Therefore in such cases Double Flowers are little to be expected; they are, in fact, rare.

136. Proliferous Flowers are those in which parts that usually have all their axillary buds dormant, accidentally develop such buds; as in the Hen and Chickens Daisy, in which the bracts of the involucrum form other Daisy-heads in their axils; or, as in certain Roses, in which the carpellary leaves develop leaf-buds in their axils, so that the flower becomes a branch, the lower leaves of which are coloured and transformed, and the upper green, and in their ordinary state.

§ 8. OF THE SEXES.

137. The sexes consist of two or more whorls of transformed leaves, of which the outer are the *Stamens* and the inner the *Pistil*.

138. They are known to be modifications of leaves, because they are frequently transformed into petals which are demonstrably leaves; and because they occasionally revert altogether to the state of leaves.

139. The stamens bear at their apex the organ called the *anther*, which contains the powder called *pollen*.

140. When full grown the anther opens and emits the pollen, either dispersing it in the air in consequence of the elasticity with which it opens; or depositing it upon the stigma; or exposing it to the action of wind, or to such other disturbing causes as may liberate it from its case.

141. The pollen consists of exceedingly minute hollow balls, or shells, containing a fertilising principle.

142. The pistil has at its base one or more cavities, or *cells*, in which young seeds or *ovules* are placed; and at its apex one or more secreting surfaces called *stigmas*.

143. If the fertilising powder of the pollen comes in contact with the stigma, the ovules in the cells of the pistil are vivified, and become seeds.

144. But if this contact does not take place, the ovules cannot be vivified, but shrivel up and perish.

145. This phænomenon is greatly assisted by warmth, and is equally impeded by cold.

146. In wild plants a stigma is usually acted upon only by the pollen of the stamens which belong to it.

147. In that case the seeds thus vivified will, when sown, produce new individuals, differing very little from the plant by which they were themselves produced.

148. And, therefore, wild plants are for the most part multiplied from generation to generation without change.

149. But it is possible to cause deviations from this law, by artificial means.

150. If the pollen of one species is placed upon the stigma of another species of the same genus, the ovules may be vivified; and a *hybrid* plant may be produced by those ovules when they shall have grown to be seeds.

151. Hybrid plants are different from both their parents, and are generally intermediate in character between them.

152. They have less power of perpetuating themselves by seeds; but they may, if woody, be propagated by cuttings, buds, scions, &c.

153. Therefore, no hybrids but such as are of a woody perennial character can be perpetuated with certainty.

154. Really hybrid plants must not be confounded with mere *crossbreds* which are intermediate between two varieties of the same species; and not between two species of the same genus.

155. Hybrid plants are often more abundant flowerers than either parent.

156. This is, probably, connected with constitutional debility.

§ 9. OF THE FRUIT.

157. Fruit, strictly speaking, is the pistil arrived at maturity.

158. When the calyx adheres to the pistil and grows with it to maturity, the fruit is called *inferior*; as the Apple.

159. But when the pistil alone ripens, there being no adhesion to it on the part of the calyx, the fruit is called *superior*; as the Peach.

160. The fruit is therefore, in common language, the flower, or some part of it, arrived at its most complete state of existence; and consequently is itself a portion of a stunted branch (107).

161. The nature of its connection with the stem is therefore the same as that of the branches with each other, or of leaves with their stem.

162. When a superior fruit consists only of one, or of a small number of metamorphosed leaves, it has little or no power of forming a communication with the earth and of feeding itself, as real branches have.

163. It has also very little adhesion to its branch; so that slight causes

are sufficient to detach it from the plant, especially at an early age, when all its parts are tender. If roots do not act freely, as is the case when earth is very cold, or when they have been much injured by transplanting, superior fruits are very apt to fall off, even although they shall have been fertilised.

164. Hence the difficulty of causing drupes to *stone*, or to pass over that age, in which the vascular bundles that join them to the branch become woody, and secure them to their place.

165. Fruit is fed upon secreted matter which it attracts to it from other parts, elaborates, and stores up in its interior.

166. The office of feeding fruit is more especially performed by young branches, which transmit nutriment to it through the bark.

167. But as young branches chiefly transmit nutriment downwards, it follows that unless a fruit is formed on a part of a branch below a leaf-bud, it is liable to perish;

168. Unless there is some active vegetation in the stem above the branch on which it grows; when it may possibly live upon secretions attracted from the main stem.

169. Inferior fruit, however, consisting at least of the calyx in addition to the pistil, has a much more powerful communication with the branch; each division of its calyx having *at least* one bundle of vascular and fibrous tissue, passing from it into the branch, and acting as a stay upon the centre to prevent its breaking off.

170. Such fruit is more capable of attracting secretions from a distance; and, consequently, is less liable to perish from want of a supply of food.

171. It is therefore not so important that an inferior fruit should be furnished with growing branches above it.

172. Fruit being exclusively fed by the secretions prepared for it by other parts, it will be large in proportion to the quantity of food the stem can supply to it; and small in proportion to the inability of the stem to nourish it.

173. For this reason, when trees are weak they should be allowed to bear very little, if any, fruit; because a crop of fruit can only tend to increase their debility.

174. And in all cases each fruit should be so far separated from all others as not to be robbed of its food by those in its vicinity.

175. We find that nature has herself in some measure provided against injury by reason of excessive fecundity, in giving them a power of throwing off flowers the fruit of which cannot be supported; as we always see happen to common fruit-trees after the flowers are over.

176. The flavour of succulent fruit depends upon the existence of certain secretions, especially of acid and sugar; flavour will, consequently, be regulated by the circumstances under which such fruit is ripened.

177. The ripening of succulent fruit is the conversion of acid and other substances into sugar and essential oils.

178. The latter substances cannot be obtained in the dark, are less abundant in fruit ripened in diffused light, and are most abundant in fruit freely exposed to air and to the direct rays of the sun.

179. Therefore, if fruit be produced in situations much exposed to the sun and air, its good quality will be augmented.

180. And in proportion as it is deprived of free air and the sun's direct rays that quality will diminish.

181. So that a fruit, which when exposed to the sun is sweet, when grown where no direct light will reach it will be acid; as Pears, Cherries, &c.

182. Hence acidity may be corrected by exposure to light and air, and excessive sweetness, or insipidity, by diminution of light.

183. As a certain quantity of acid is essential to render fruit agreeable to the palate, and as it is the property of cultivated fruits to add to their saccharine matter, but not to form more acid than when wild, it follows that, in selecting wild fruits for domestication, those which are acid should be preferred, and those which are sweet or insipid rejected.

184. Unless recourse is had to hybridism, when a wild insipid fruit may be possibly improved, or may be the means of improving something else.

IX. OF THE SEED.

185. The seed is the ovule arrived at perfection.

186. The seed is nourished by the same means as the fruit; and, like it, will be more or less perfectly formed, according to the quantity and quality of its food.

187. The plant developed from the embryo of the seed will be in all essential particulars like its parent species;

188. Unless its nature has been changed by hybridising.

189. But although it will certainly, under ordinary circumstances, reproduce its species, it will by no means uniformly reproduce the particular variety by which it was borne.

190. So that seeds are not the proper means of propagating varieties.

191. Nevertheless, in annual or biennial plants, no means can be employed for propagating a variety, except the seeds; and yet the variety is preserved.

192. This is accomplished solely by the great care of the cultivator, and happens thus:

193. Although a seed will not absolutely propagate the individual, yet as a seed will partake more of the nature of its actual parent than of any thing else, its progeny may be expected, as really happens, to resemble the variety from which it sprung, more than any other variety of its species;

194. Provided its purity have not been contaminated by the intermixture of other varieties.

195. By a careful eradication of all the varieties from the neighbourhood of that from which seed is to be saved, by taking care that none but the most genuine forms of a variety are preserved, as seed-plants; and by compelling by transplantation a plant to expend all its accumulated sap in the nourishment of its seeds, and not in the superabundant production of foliage, a crop of seed may be procured, the plants produced by which will, in a great measure, have the peculiar properties of the parent variety.

196. By a series of progressive seed-savings upon the same plan, plants will be at length obtained, in which the habits of the individual have become as it were fixed, and capable of such exact reproduction by seed, as to form an exception to the rule; as happens in Turnips, Radishes, &c.

197. But if the least neglect occurs in taking the necessary precautions to ensure a uniform crop of seed, possessing the new fixed properties, the race becomes deteriorated, in proportion to the want of care that has occurred, and loses its character of individuality.

198. When seeds are ripe, their embryo will remain torpid until fitting circumstances occur to call it into active life.

199. These fitting circumstances are, a temperature above 32° Fahr., a moist medium, and exposure to air.

200. It then absorbs the moisture of the medium in which it lies, and undergoes certain chemical changes; its vital powers cause it to ascend by one extremity for the purpose of finding light, and to descend by the other extremity for the purpose of finding a constant supply of food.

201. Unless these conditions are maintained, seeds cannot germinate; or if they do germinate they cannot live more than a few hours.

X. OF SAP.

202. The fluid matter which is absorbed either from the earth or from the air is called sap.

203. When it first enters a plant it consists of water holding certain substances in solution.

204. These substances consist for the most part of ammonia, phosphoric and carbonic acids, and of alkaline or earthy matter.

205. Sap soon afterwards acquires the nature of mucilage or sugar, and subsequently becomes still further altered by the admixture of such soluble matter as it receives in passing in its route through the younger and external part of the wood.

206. When it reaches the vicinity of the leaves it is attracted into them, and there, having been exposed to light and air, is converted into the secretions peculiar to the species.

207. Finally, in its altered state, it sinks down the bark, whence it is given off laterally by the medullary rays, and is distributed through the system.

208. No solid matter whatever can be taken up by the roots. It is owing to this circumstance that liquid manure, which contains all its soluble matter in a fluid state, acts with so much more energy than solid substances.

209. The cause of the motion of the sap is the attraction of the leaf-buds and leaves.

210. The leaf-buds, called into growth by the combined action of the increasing temperature and light of spring, attract fluid from the tissue immediately below them; the space so caused is filled up by fluid again attracted from below, and thus a motion gradually takes place in the sap from one extremity to the other.

211. Consequently the motion of the sap takes place first in the branches and last in the roots.

212. For this reason a branch of a plant subjected to a high temperature in winter will grow while its stem is exposed to a very low temperature.

213. But growth under such circumstances will not be long maintained, unless the roots are secured from the reach of frost: for, if frozen, they cannot act, and will, consequently, be unable to replace the sap of which the stem is emptied by the attraction of the buds converted into branches, and by the perspiration of the leaves.

214. Whatever tends to inspissate sap, such as a light dry and heated atmosphere, or to interrupt its rapid flow, has the property of causing excessive vigour to be diminished, and flower-buds to be produced.

215. While, on the other hand, whatever tends to dilute the sap, such as a dark damp atmosphere, with a free and uninterrupted circulation, has the property of causing excessively rapid growth, and an exclusive production of leaf-buds.

216. Inspissated or accumulated sap is, therefore, a great cause of fertility.

217. And thin fluid, not being elaborated, is a great cause of sterility.

218. The conversion of sap into different kinds of secretion is effected by the combined action of *Air*, *Light*, and *Temperature*.

XI. OF AIR AND LIGHT.

219. An embryo plant is usually colourless, or nearly so; but, as soon as it begins to grow, that part which approaches the light (the stem) becomes coloured, while the opposite extremity (the root) remains colourless.

220. The parts exposed to the air absorb carbonic acid and part with oxygen; and thus purify the air, and render it fit for the respiration of man.

221. The intensity of this latter phænomenon is in proportion to the intensity of solar light to which leaves are directly exposed.

222. Its cause is the decomposition of carbonic acid, the extrication of oxygen, and the acquisition by the plant of carbon in a solid state.

223. Moreover the intensity of colour and the quantity of secretion are in proportion to the exposure to light and air; as is shown by the deeper colour of the upper side of leaves, &c. And by the fact, that if plants be grown in air from which light is excluded, neither colour nor secretions are formed, as is exemplified in blanched vegetables; which, if even naturally hurtful, may, from want of exposure to light, become wholesome as Celery.

224. When any colour appears in parts developed in the dark it is generally caused by the absorption of such colouring matter as pre-existed in the root or other body from which the blanched shoot proceeds, as in some kinds of Rhubarb when forced;

225. Or by the deposition of colouring matter formed by parts developed in light, as in the subterranean roots of Beet, Carrots, &c.

226. What is true of colour is also true of flavour, which equally depends upon light for its existence; because flavour is produced by chemical alterations in the sap caused by exposure to light.

227. The same thing occurs in regard to organisable matter, which in like manner is formed by the exposure of leaves to light. Thus the Potato when forced in dark houses contains no more amylaceous matter than previously existed in the original tuber; but acquires it in abundance when placed in the light, and in proportion as it is influenced by light and air. Thus, also, if Peaches are grown in greenhouses, at a distance from the light, they will form so little organisable matter as to be unable to support a crop of fruit, the greater part of which will fall off. And for a similar reason it is chiefly the outside shoots of orchard trees that bear fruit.

228. Light is, except warmth, the most powerful stimulus that can be employed to excite the vital actions of plants, and its energy is in proportion to its intensity; so that the direct rays of the sun will produce much more powerful effects than the diffused light of day.

229. Hence, if buds that are very excitable are placed in diffused light, their excitability will be checked.

230. And if buds that are very torpid are exposed to direct light, they will be stimulated into activity.

231. So that what parts of a tree shall first begin to grow in the spring may be determined at will.

232. This is why attention must be paid to shading buds from the direct rays of the sun: as in the case of cuttings, whose buds, if too rapidly excited, would exhaust their only reservoir of sap, the stem, before roots were formed to repair such loss.

XII. OF PERSPIRATION.

233. It is not exclusively by the action of light and air that the nature of sap is altered. Evaporation is constantly going on during the growth of a plant, and sometimes is so copious that an individual will perspire its own weight of water in the course of twenty-four hours.

234. The loss thus occasioned by the leaves is supplied by fluid matter, absorbed by the roots, and conveyed up the stem as it is wanted.

235. The consequence of such copious perspiration is the solidification of whatever matter is produced.

236. For the maintenance of a plant in health, it is indispensable that the supply of fluid by the roots should be continual and uninterrupted.

237. If anything causes perspiration to take place faster than it can be compensated for by the absorption of fluid from the earth, plants will be dried up and perish.

238. Such causes are, destruction of spongioles, an insufficient quantity of fluid in the soil, an exposure of the spongioles to occasional dryness, and a dry atmosphere.

239. The most ready means of counteracting the evil consequences of an imperfect action of the roots is by preventing or diminishing evaporation, and by raising the temperature of the soil.

240. This is to be effected in part by rendering the atmosphere extremely humid, and in part by warming the soil, by the sun, by drainage, or by other means.

241. Thus, in hothouses, in which the atmosphere may become so dry in consequence of the heat that plants perish, it is necessary that the air should be rendered extremely humid, by throwing water upon the pavement, or by introducing steam, or by frequent syringing.

242. And in transplantation in cold dry weather, evergreens, or plants in leaf, often die, because the spongioles are destroyed, or so far injured in the operation as to be unable to act, while the leaves never cease to perspire.

243. The greater certainty of transplanting plants that have been growing in pots is from this latter circumstance intelligible; as is also the advantage of transplanting evergreens in the warm months of the autumn.

244. While the utility of putting cuttings or newly transplanted seedlings into a shady damp atmosphere, is explained by the necessity of hindering evaporation.

XIII. OF CUTTINGS.

245. When a portion of a plant is caused to produce new roots and branches, and to increase an individual, it is a cutting.

246. Cuttings are of two sorts,—*cuttings* properly so called, and *eyes*.

247. A cutting consists of a small branch with its buds.

248. When the cutting is placed in earth it attracts fluid from the soil, and nourishes the buds until they can feed themselves.

249. The buds feeding at first upon the matter in the branch, gradually shoot upwards into branches, and send organised matter downwards, which becomes roots.

250. As soon as the cutting has established a communication with the soil, it becomes a new individual, exactly like that from which it was taken.

251. As it is the action of the leaf-buds that causes growth in a cutting, it follows that a cutting without a leaf-bud will not grow.

252. Unless the cutting has great vitality and power of forming adventitious leaf-buds; which sometimes happens.

253. An eye is a leaf-bud without a branch.

254. It only differs from a cutting in having no reservoir of food on which to exist, and in emitting its roots immediately from itself into the soil.

255. As cuttings will very often, if not always, develop leaves before any powerful connection is formed between them and the soil, they are peculiarly liable to suffer from perspiration.

256. Hence the importance of maintaining the atmosphere in an uniform state of humidity, as is effected by putting bell glasses or other coverings over them.

257. Layers differ from cuttings in nothing except that they strike root into the soil while yet adhering to the parent plant.

258. Whatever is true of cuttings is true of layers, except that the latter are not liable to suffer by evaporation, because of their communication with the parent plant.

259. As cuttings strike roots into the earth by the action of leaves or leaf-buds, it might be supposed that they would strike most readily when the leaves or leaf-buds are in their greatest vigour.

260. Nevertheless, this power is controlled so much by the peculiar vital powers of different species, and by secondary considerations, that it is impossible to say that this is an absolute rule.

261. It is to avoid the bad effect of evaporation that leaves are usually for the most part removed from a cutting, when it is first prepared.

XIV. OF SCIONS.

262. A scion is a cutting which is caused to grow upon another plant, and not in earth.

263. A stock is the plant on which the scion is caused to grow.

264. Scions are of two sorts, *scions* properly so called, and *buds*.

265. Whatever is true of cuttings is true also of scions, all circumstances being equal.

266. When a scion is adapted to another plant, it attracts fluid from it for the nourishment of its leaf-buds until they can feed themselves.

267. Its buds thus fed gradually grow upwards into branches, and secure themselves to the branch by new cellular tissue formed at the place where the scion joins the stock.

268. The scion and stock always retain each its own quality, notwithstanding their being united; so that whatever shoots are produced below the union of the scion and stock is of the nature of the latter, and above the union is of the nature of the former.

269. When the communication between the stock and the scion is so much interrupted that sap can no longer ascend with sufficient rapidity into the branches, the latter die; as in many Peach-trees.

270. This incomplete union between the scion and the stock is owing to some constitutional or organic difference in the two.

271. Therefore care should be taken that when plants are grafted one another their constitution should be as nearly as possible identical.

272. As adhesion of only an imperfect nature takes place when the scion and stock are to a certain degree, dissimilar in constitution, so will no adhesion whatever occur when their constitutional differences are very decided.

273. Hence it is only species very nearly allied in nature that can be grafted on each other.

274. As only similar tissues will unite, it is necessary in applying a scion to the stock that similar parts should be carefully adapted to each other; as bark to bark, cambium to cambium, and alburnum to alburnum.

275. The second is more especially requisite, because cambium itself, being organising matter in a nascent state, will more readily form an adhesion than any other part.

276. The same principles apply to *buds*, which are to scions precisely what eyes are to cuttings.

277. It is, however, only when buds are completely formed that they possess the power of growing upon another plant.

XV. OF TRANSPLANTATION.

278. Transplantation consists in removing a plant from the soil in which it was growing to some other soil.

279. If during the operation the plant is torpid, and its spongioles uninjured, the removal will not be productive of any interruption to the previous rate of growth.

280. And if it is growing, or evergreen, and the spongioles are uninjured, the removal will produce no further injury than may arise from the temporary suspension of the action of the spongioles, and the continued action of perspiration during the operation.

281. So that transplantation may take place at all seasons of the year, and under all circumstances, provided the spongioles are uninjured.

282. This applies to the largest trees as well as to the smallest herbs.

283. But as it is impossible to take plants out of the earth without destroying or injuring the spongioles, the evil consequences of such accidents must be remedied by the hindrance of evaporation.

284. Transplantation should therefore take place either when plants are torpid, and when their respiratory organs (leaves) are absent; or, if they never lose those organs, as is the case with evergreens, at seasons when the atmosphere is periodically charged with humidity for some considerable time; or else in the early autumn when the warm earth promotes the rapid renewal of such roots as may have been destroyed.

285. Plants in pots, being so circumstanced that the spongioles are protected from injury, can be transplanted at all seasons, without any dangerous consequences.

286. Notwithstanding the importance of spongioles, plants will survive without difficulty the loss of a large part of them, provided enough are left to enable the roots to act until new spongioles are formed, or provided the skin of the roots is soft enough to absorb fluids very freely.

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THE END.

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