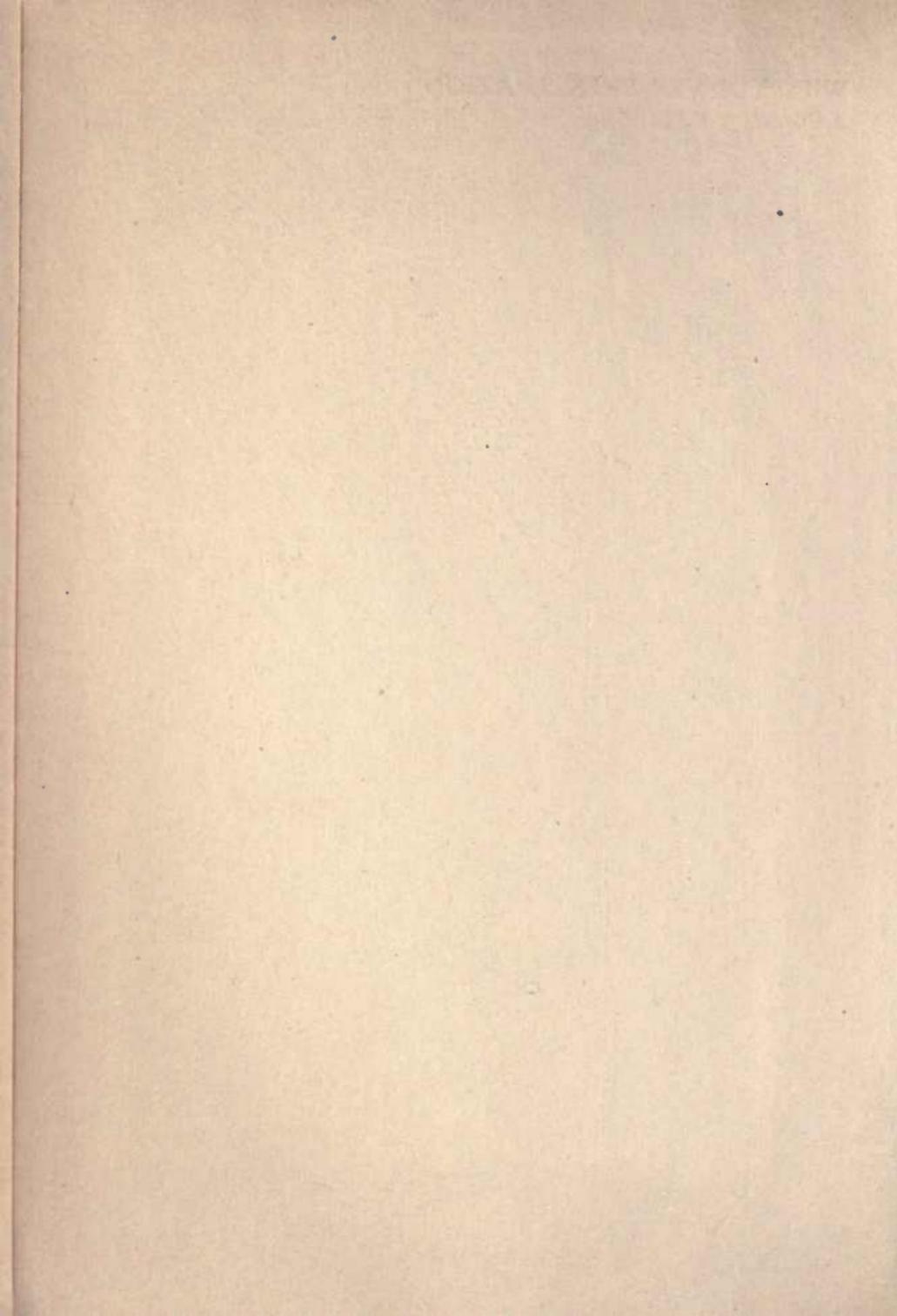


WILD FLOWER RESERVATION

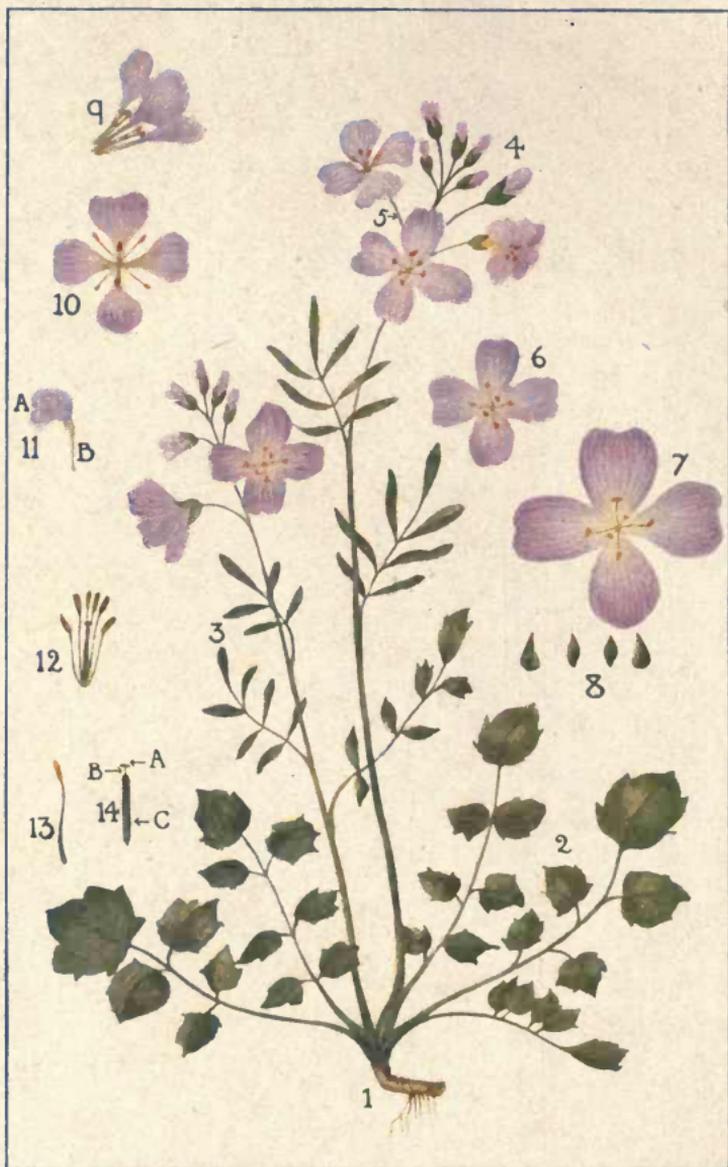


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WILD FLOWER PRESERVATION

A COLLECTOR'S GUIDE



CUCKOO FLOWER, WITH THE DIFFERENT PARTS OF THE FLOWER ENLARGED (*see p. 104*).

WILD FLOWER PRESERVATION

A COLLECTOR'S GUIDE

BY

MAY COLEY

AND

CHARLES ALFRED WEATHERBY

WITH TWENTY-NINE ILLUSTRATIONS BY HILDA M. COLEY,
UNA L. FOSTER AND FROM PHOTOGRAPHS



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 February, 1915

NOTE

THE Authors acknowledge the kind permission of Messrs. Macmillan & Co., Ltd., for the inclusion of Figs. 79 A and B (from Sir J. D. Hooker's *Botany*), and of Mr. John Grant for Figs. 85 and 89 A and B, in this book (from *Flowers: Their Origin, Shapes, Perfumes, and Colours*, by J. E. Taylor, F.G.S., F.L.S.).

PREFATORY NOTE

In revising this little book for use in America, I have tried to make as few alterations as possible. It has been necessary to substitute American books and American flowers for the unfamiliar English ones mentioned by Miss Coley, and to change somewhat her directions for pressing and mounting plants in favor of methods which experience with my own collection and in one of the great public herbaria has convinced me are quicker and better than those which she describes. But the plan and spirit of the book are hers; hers, also, are its chief merits.

C. A. WEATHERBY.

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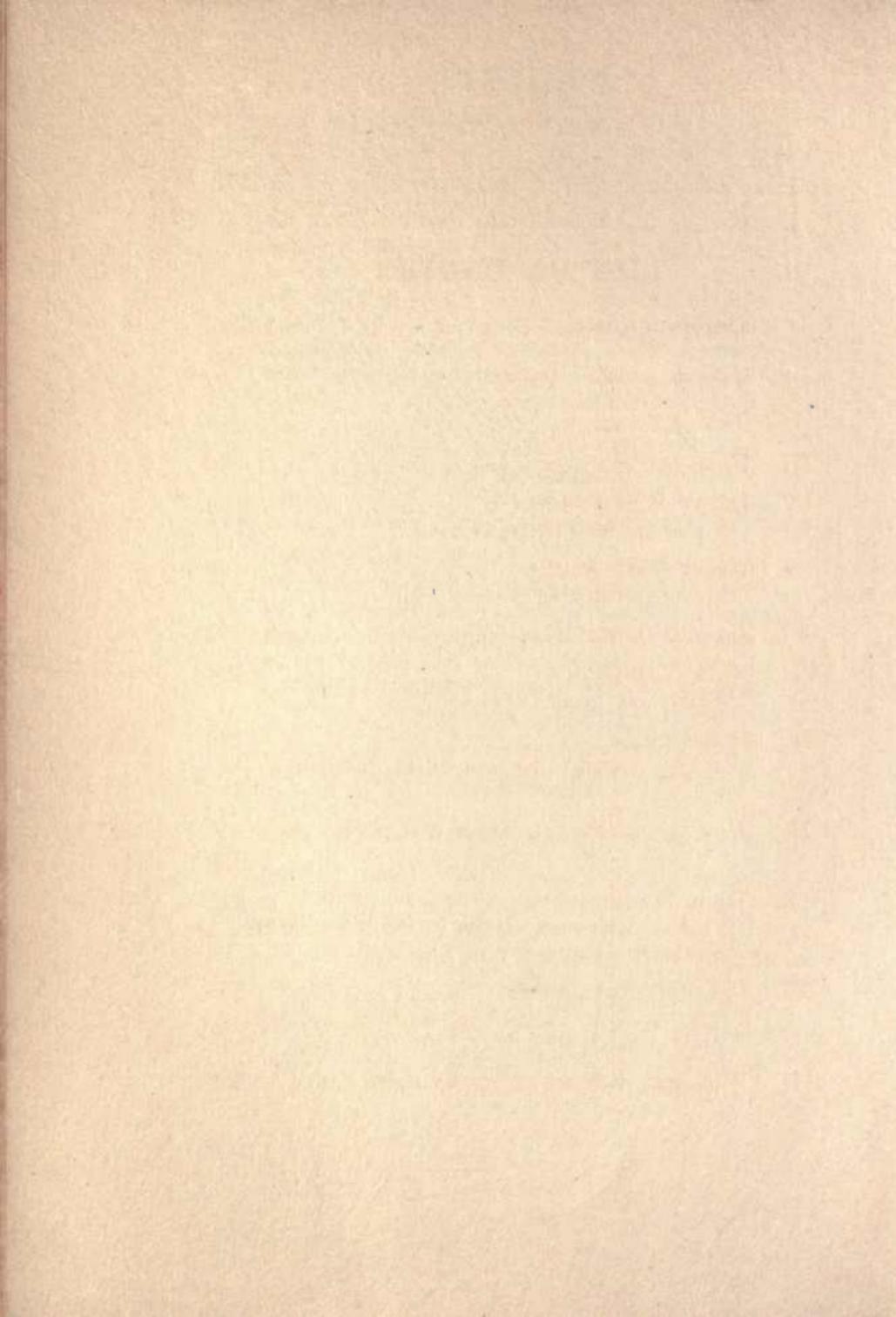
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FOREWORD

“The most helpful and sacred work which can at present be done for humanity, is to teach people . . . not ‘how to better themselves,’ but how to ‘satisfy themselves.’ . . . And in order to teach men how to be satisfied, it is necessary fully to understand the art of joy and humble life . . . the life of domestic affection and domestic peace, full of sensitiveness to all elements of costless and kind pleasure;—therefore chiefly to the loveliness of the natural world. . . . We shall find that the love of nature, wherever it has existed, has been a faithful and sacred element of feeling; . . . Nature-worship will be found to bring with it such a sense of the presence and power of a Great Spirit as no mere reasoning can either induce or controvert; . . . it becomes the channel of certain sacred truths, which by no other means can be conveyed.”

JOHN RUSKIN, *Frondees Agrestes*.

WILD FLOWER PRESER- VATION

CHAPTER I

FOREWORD

Wild Flower Preservation for flower lovers and amateur students—For more advanced naturalists failing to preserve plants successfully—For boys and girls at school—Preservation of plants an art in itself—No haphazard performance—That prosaic word “herbarium”—A doleful definition—A dainty collection of plants—Poetry and flowers inseparable.

Wild Flower Preservation has been written mainly for the amateur botanist, the ordinary lover of Nature who, whether living in the country or visiting it only at rare holiday times, yet longs to know the names and ways of plants; how they are related to one another; how they protect themselves from their enemies—whether those enemies are cows or merely tiny ants and soft-bodied slugs—how

such plants grow and develop from the tiny seedlings greening the banks in spring into the waving trails of summer foliage and the wonder of flower and fruit.

Many such amateurs may be town and city dwellers, ignorant of the names of all but the commonest flowers, yet eager to grasp every chance of a few hours in the country; to escape from the din and strain of the streets into the peace and the sweet air of flower-land; eager, too, to enter into the life of this glorious wonderland.

But some of you have been living in a world of flowers for years, almost asleep to its loveliness, its mystery and its joy. But in an idle moment you peeped into the heart of a flower. It "stabbed your spirit broad awake," and ever since you have seen more of the world you live in and have tried to learn something of the miracles worked daily in the fence-rows and by the common roadside.

To all such readers I hope *Wild Flower Preservation* will be a help and an inspiration, not only through what you may learn from its own pages, but because of the introductions it

gives you to other and wiser books. I only stand just within the Gate called Beautiful beckoning you to enter the Temple; teaching you how to watch and how best to learn, and giving to each the guides who shall unfold the greater mysteries beyond.

There are, too, many students, both amateurs and more experienced botanists, who wish to do something beyond learning the names and ways of plants. They want some beautiful memento of their spring and summer rambles and of the differing floras of their holiday haunts. They would like to preserve some of the plants they find. I hope this book will help all such students to do this successfully.

Some of you may chance to be most experienced and advanced naturalists; but in spite of your knowledge of plant-life you are disappointed with the result of drying and pressing your flowers, and you are conscious that your herbarium is anything but beautiful. If so, and if it *also* chances that you have a humble and teachable spirit, there is no reason why you should not soon turn these mournful col-

lections into the most delightful of possessions!

Some of you may be even yet at school and fired with a desire to make the school herbarium "a thing of beauty and a joy forever," instead of a dismal cemetery of departed loveliness as it too often is! I hope I shall be able to help you girls and boys to realize your wish.

But *Wild Flower Preservation* has not been written for the professional botanist or the lordly being who knows quite well that plants cannot be pressed successfully; so if you are that type of soured or learned person let me implore you to put the book down at once! It will not interest you.

Now it is very easy for students to dream dreams of wonderful herbaria and of glorious mementoes of wild-flower land. You must remember that preserving wild flowers is an art and not the incidental and haphazard performance that many people have supposed. Flicking flowers into a book for preservation or rapidly tucking them between the sheets of a blotting and newspaper bed bear just

about the same relationship to the real art as crystoleum painting to the work of Millais! They are not even "in the running"; so please take the art of pressing wild flowers as seriously as you would any other.

It has been the fashion in some quarters to deride the herbarium and to speak very loftily of the superiority of an intelligent knowledge of living plants over a mere prosaic collection of dried specimens; flat, mangled, miserable objects that have meant the destruction of much wayside beauty and by no means always increased the botanical knowledge of their collector.

All this sounds very derisive, and very discouraging, and certainly very superior; but just a little thought shows us that too many assumptions are made in such statements.

The glib repetition of Latin names, of plant organs and their numbers never yet made a botanist—though it has often made a bore! Therefore "an intelligent knowledge of living plants" is what every true botanist strives after, whether he preserves his "finds" or not;

but it is this same knowledge that helps to make the herbarium natural and lovely.

A collection of dried plants need not be prosaic and the specimens need not look "mangled and miserable." The truth is that many botanists in the past had more learning than patience and common sense, and their collections have so discouraged the younger generation of naturalists that many of these have given up pressing any but their rarer "finds." This is a great pity for if plants are carefully and sensibly pressed most of them remain beautiful to the end, and when mounted they are of infinitely greater value than any colored plate or printed description.

You may think that detailed instructions for preserving plants are rather prosaic, and that there is little romance or poetry about drying-papers; but though yours is only preservative work the same complaint may be made of the tools used in creative art. There is nothing specially attractive in a sculptor's chisel or in charcoal and canvas, and no poetical charm about a tube of paint; though I will admit that this last seems most delightful

and enthralling to a tiny child—so long as its mother's back is turned!

Perhaps the old definitions have helped to surround the subject with gloom. A well-known dictionary, published in 1861, gives the following enchanting explanation of the word: "Herbarium, a collection of dried plants or their more important botanical parts. (Usually flattened and glued on sheets of paper.)" It is of course correct, yet how woefully unattractive it sounds! It is surely enough to scare away all desire for such gloomy possessions! I suggest the following as an alternative: "A collection of plants preserved by pressure and the absorption of moisture, and afterwards so mounted upon card or paper as to show their natural grace and beauty and general mode of growth."

This of course describes the collection as it should be.

I must admit that the very word "herbarium" sounds prosaic, and that the terms "dried plants" and "specimens" are absolutely devoid of poetry. That is just the pity of it all, for flowers and poetry should be in-

separable. Who will give us a word instead of "herbarium," some word with a vision in it, a vision of all the grace and loveliness of wild-flower land?

THE
BOTANICAL
OUTFIT

“Therefore all seasons shall be sweet to thee,
Whether the summer clothe the general earth
With greenness, or the redbreast sit and sing
Betwixt the tufts of snow on the bare branch
Of mossy apple-tree.”

COLERIDGE.

“To the attentive eye each moment of the year has its own beauty, and in the same field, it beholds, every hour, a picture which was never seen before, and which shall never be seen again.”

EMERSON.

CHAPTER II

THE BOTANICAL OUTFIT

Must be orderly and neat—A list of requisites—Working expenses small after initial outlay—Well illustrated Flora indispensable—How to secure second-hand books—How to make a press—Separate mounts *versus* albums—Cabinet for storing the collection.

A BOTANICAL outfit may be as simple or as elaborate as your purse permits, but it must always be orderly, neat, and dainty.

Naturalists, like artists and poets, were once supposed to be more or less addicted to long hair and goggles, to be absent-minded and to have souls above order; but such ideas are fast dying out, for the true naturalist, even of the most bespectacled variety, has cupboards and drawers arranged with the utmost care, and woe betide the unlucky wight who meddles with these things!

When gathering together a botanical outfit, be sure that all is as good and neat as you can make it, and then keep it so.

The following list gives all the articles necessary for an amateur botanist anxious both to study and preserve plants. Those who have no intention of pressing and mounting their "finds" will require only the first ten items.

1. Basket or Collecting Case.
2. Scissors.
3. Trowel or old Tablespoon.
4. Supply of old Newspapers.
5. Well illustrated Flora.
6. Some simple book on Plant Study.
7. Magnifying-glass.
8. Sharp Penknife.
9. Dissecting Needles.
10. A Nature Note-book and Pencil.
11. Botanical Press with double Strap.
12. Stock of Drying-papers and Folders.
13. Small and large Brush.
14. Small quantity of Cotton-wool or Wadding.
15. Mounting-papers and Genus-covers, or Album.
16. Piece of Plate or Window Glass.
17. Liquid Glue.

18. Gummed Paper or Surgeon's Silk Isinglass Plaster.
19. Labels.
20. Pair of Forceps.
21. Case or Boxes for storing mounted plants.
22. Moth-balls.

This seems a long list, but Nos. 5 and 6 are the only necessarily expensive items. Most people already possess Nos. 1, 2, 3, 4, 8, 14 and 22; Nos. 9, 11, 21 and even 12 may be manufactured at home, and the rest can be secured for a moderate sum. After the initial outlay, the working expenses of this study are very small.

1. *The Basket or Collecting Case.*—Collecting cases or "vasculums" are used by most botanists. These are tin boxes in the form of a slightly flattened cylinder and with a hinged cover opening along the entire length; and there is nothing better for their purpose. The secret of keeping plants fresh lies in keeping them from the air; and these tin boxes are practically air-tight. The Bausch & Lomb Optical Co. of Rochester, N. Y., sell a very

good and light vasculum, 16 x 7 x 5 inches, with strap for carrying, for \$2.50; and the Cambridge Botanical Supply Co. of Waverley, Mass., have two sizes—one, 18 x 6½ x 4½ inches, for \$1.50 and a larger one with a separate compartment for delicate specimens, for \$2.50, both without strap.

If you do not wish to buy a collecting case, a basket will serve. An old fashioned one with a lid is best; when this cannot be obtained, secure an ordinary oblong market-basket. Line it with paper, the better to keep out the air, and if it has no cover, put a piece of paper over your specimens and tuck it in round the edges. If you are caught out without your equipment, you can sometimes get a plant home in fairly good condition by merely wrapping it tightly in paper.

2. *Scissors*.—Many plants are better cut with scissors than pulled and broken off by the fingers, and much unnecessary uprooting is thus avoided.

3. *Trowel, or old Tablespoon*.—A trowel is necessary when roots are to be studied, and this should be done whenever the plants are

unknown to the collector and there is no danger of exterminating them. Do all in your power to prevent the wholesale destruction of plant life so common among a certain class of amateur botanists.

An old cooking tablespoon makes a good substitute for the trowel, and it is lighter and smaller to carry.

4. *Old Newspapers*.—These have many possible uses for plant collectors, but their chief service in the field is in bringing home water-plants. Most of these wither very quickly if put into a basket like other plants, but if first wrapped in three or four thicknesses of dampened newspaper, they will reach home, even after many hours, in an only slightly wilted condition in which the leaves are often more easily handled and less given to sticking together than when perfectly fresh. They can be restored to entire freshness by floating in a bowl of water.

5. *A well illustrated Flora*.—This is a most important item and little can be done without it. If a Flora is to be of much value to an amateur it must have a liberal number of

plates, and these make any book costly. There are wonderful volumes on the market advertised as containing "descriptions" of so many thousand species; but they are "sair" reading for beginners, who depend so much upon pictures for identifying their plants, and who flounder hopelessly among the shoals of technical terms offered as the only means of determining the species. A well illustrated Flora interests at once for it seems to be full of life.

There is, at present, no single work which describes all the plants of North America, or even of the United States. Indeed, our country is so large and varied and the number of different plants which grow in it so great, that, for the amateur, such a book would not be at all desirable. It would be so huge, and so difficult and clumsy to use.

The following books treat different parts of the United States and Canada:

Northeastern Section

Britton and Brown's *Illustrated Flora of the Northern States and Canada*, 3 vol.,

quarto, \$13.50, Charles Scribner's Sons, New York. This is the only work which attempts to give pictures of all the plants of any part of North America. It covers a territory extending from the southern boundary of Virginia to the Arctic regions and west to the 100th meridian and has line drawings, of varying degrees of excellence but usually helpful, of no less than 4,666 species.

Gray's *New Manual of Botany*, \$2.50, American Book Co., New York (edition on thin paper, bound in limp leather, convenient for carrying into the field, \$3.00). This, the latest of the well-known series of Gray's Manuals, covers about the same territory as the *Illustrated Flora*, except that it takes the 48th parallel as its northern boundary. It contains more than nine hundred small but admirable line drawings of flowers or important details in the more difficult groups of plants.

These are technical works. If you carry your botanical studies very far, you will want one or both of them; but for the beginner some simpler and less comprehensive book is easier to use. Such are:—

Schuyler Mathews's *Field Book of American Wild Flowers*, \$2.00, G. P. Putnam's Sons, New York, in limp leather binding, \$2.50. This book, of convenient pocket size, contains twenty-four colored plates and many excellent line drawings illustrating, in all, 696 species more or less completely. There are brief and simple descriptions and incidental notes on methods of fertilization. The plants are arranged systematically (that is, according to the families to which they belong). There is a key, based on the characters of the leaves and the number of parts of the flowers, and also a color-index to aid in identification.

Mrs. William Starr Dana's *How to Know the Wild Flowers*, \$2.00, Charles Scribner's Sons, New York, with 158 plates, 48 colored, the rest line drawings. The plants are arranged, first under the color of their flowers and then according to the months in which they blossom, a popular method which makes identification very simple for beginners. In all, about five hundred species are described.

Alice Lounsberry's *A Guide to the Wild Flowers*, \$1.90, Frederick A. Stokes Co., New

York, with 64 colored plates and 100 line drawings. This book describes about 500 species, chiefly of the northeastern section, but including a few from the West and South. The plants are arranged according to the situations in which they grow, from water-plants to those of dry ground; then according to their families and time of flowering. There are descriptions of some of the larger families.

Southeastern Section

Alice Lounsberry's *Southern Wild Flowers and Trees*, \$3.75. Frederick A. Stokes Co., New York, with 177 plates, 16 colored, the rest line or wash drawings. The plants are arranged systematically with a key to the families to aid in identification.

Rocky Mountain Region

Julia Henshaw's *Mountain Wild Flowers of America*, \$2.00, Ginn & Co., Boston, has 99 excellent half-tone plates from photographs. The plants are arranged according to the color of the flowers.

Stewardson Brown's *Alpine Flora of the*

Canadian Rocky Mountains, \$3.00, G. P. Putnam's Sons, New York, with 79 plates, illustrating more than twice as many species, thirty of them colored, the rest half-tones from photographs. The plants are arranged systematically with key, glossary, etc. Though the work is intended to cover only that portion of the Rocky Mountains traversed by the Canadian Pacific Railway, it describes many species of wide range in the mountains.

California

Mary Elizabeth Parsons's *Wild Flowers of California*, \$2.00, Cunningham, Curtis & Welch, San Francisco, has about 150 good line drawings. The flowers are arranged according to color.

Let me tell you for your comfort that second-hand copies (earlier editions) of expensive Floras can be bought for considerably less than the prices quoted above. Your bookseller will advertise for you in his trade journal, which circulates among second-hand book-dealers. This will not cost more than a few cents.

6. *A simple book on Plant Study*.—See p. 65, where this subject is fully treated.

7. *Magnifying-glass*.—This is essential, for it is impossible to examine minute flowers with the naked eye. A linen tester makes a cheap and convenient glass. It can be folded up to take into the field and when opened out at home makes a good dissecting glass under which to separate and examine small parts of a flower. Testers may be bought from 25 cents upward: choose one with a strong, clear lens and the largest obtainable opening in the standard.

8. *Sharp Penknife*.—This is used when dissecting flowers, a very necessary process if you are to know them thoroughly. The knife must be kept perfectly sharp and clean and must on no account be used for any other purpose.

9. *Dissecting Needles*.—These are easily made, and I cannot do better than quote Professor Henslow's instructions for mounting two large needles (fours or fives) in penholders:—

“Thrust the point into the broad end of a wooden penholder; then take it out, break the

needle in two, and thrust the broken end of the pointed half into the hole."

10. *A Nature Note-book and Pencil*.—The former should be of exercise-book shape, bound in cloth. It will cost 15 to 25 cents. A loose-leaf note-book is still better. See Chapter III for further details.

11. *Botanical Press with double Strap*.—A Botanical Press consists of two flat, oblong boards of equal size and thickness, a little larger than your mounting paper, and a number of sheets of drying-paper to fit them. The whole is kept in place by a double strap which is tightened or loosened according to the number of plants and drying-sheets in the press. Such a press is easily made at home. Well-seasoned wood must be bought for this purpose, and it should not be less than $\frac{1}{2}$ in. in thickness. Cut it to the required size, bevel the edges slightly and sandpaper the whole until it is as smooth as possible. If the wood is white or of very light color it should be stained a darker shade, for light wood shows the least soil. Presses should never be varnished or polished. Wood that has to be constantly

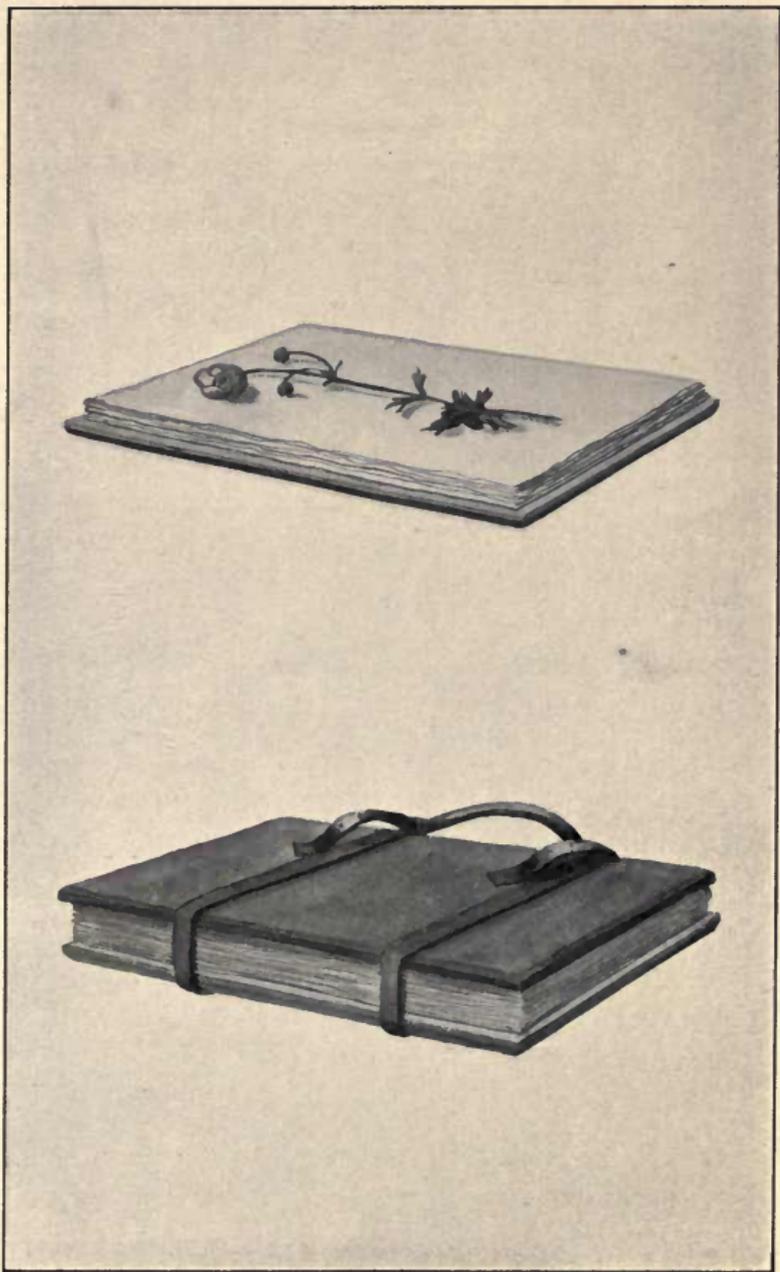


PLATE I.—THE BOTANICAL PRESS OPEN AND CLOSED.

handled is better left with a dull surface. Plate I shows the press open and fastened up.

A still better press, and one which requires no great skill in carpentering to manufacture, has, instead of solid boards, a lattice-work of ash slats, $\frac{1}{4}$ inch thick and an inch wide. These should be laid at right angles to one another and one or two inches apart and should be secured at the corners and all intersections with two or three wire brads, securely clinched and preferably of brass which will not rust. Such presses, to fit drying sheets of the standard size (12 x 18 inches), can be bought, without straps, from the Cambridge Botanical Supply Co. for from 60 cents upward according to size and material used. The model which costs \$1.35 is the most generally serviceable.

12. *Drying-papers and Folders.*—It is necessary to keep a good stock of these, for plants require several changes of paper before they are fit for mounting, and stinginess in this item is fatal. Botanical drying-paper may be bought from 35 cents per quire, according to weight. Thick white blotting-paper is almost equally good and costs about the same. Pads of old

newspapers, folded and cut to size, will also do if the paper is without any glaze; but they do not absorb moisture so rapidly and if you use them you must be particularly careful to change driers frequently.

You should also have a good supply of sheets of newspaper stock or old newspapers cut as long as your mounting sheets and twice as wide, so that when folded once they form covers of the same size as the sheets. Plants to be pressed are placed in these covers; they can then be moved when changing driers without actually touching them and without disturbing their position, which you will probably have been at some pains to make natural and graceful. Newspaper stock, cut to size, costs 50 to 75 cents per ream at the paper-dealer's.

All papers can be used and dried an indefinite number of times.

13. *Brushes.*—You will want a soft paint-brush, size 2, to use when arranging the plants in the press, for they must be touched as little as possible by warm fingers, and a large, coarse brush an inch or two across for spreading glue.

14. *A small quantity of Cotton-wool.*—This

is used in the form of pads to equalize pressure round knobby flower-heads (see Chapter VII).

15. *Mounting-papers and Genus-covers, or Albums.*—Some botanists mount their plants in albums, and there is something to be said for this method. The card leaves are firm and the specimens are protected from shuffling. It is, however, impossible to arrange plants scientifically in this way for they must be mounted in the order in which they were found. Pages may be allotted to various Genera and Families, but miscalculations are bound to occur. Plants ought to be arranged according to their Families, and if separate mounting-sheets are used this is easily done for all of one Family can be kept together.

Professional botanists in America have, after long experience, agreed on a standard size for mounting sheets, $11\frac{1}{2} \times 16\frac{1}{2}$ inches, and this size will, on the whole, be found most convenient for a variety of plants. The best paper is a good quality of linen ledger, weighing not less than twenty pounds per ream when cut to the above size. This kind of paper

cannot be obtained from every dealer, but may be bought from those mentioned in section 1 at 30 cents per quire, \$5.00 per ream and upward, according to weight. Heavy white drawing paper makes an excellent, and much cheaper, substitute. The grades sold by the Milton Bradley Co., Boston, under the trade names of Bradley's White, Nos. 1 and 2, Springfield White and American White are all good—the second and fourth heaviest and stiffest and therefore best. In sheets 12 x 18 inches, which can be cut to size with little waste, these papers cost \$1.40 to \$2.40 per ream. Smaller quantities may be bought at corresponding prices and all grades should be obtainable of dealers in school supplies.

Genus-covers are folders of heavy manila wrapping or tag paper, slightly larger than the mounting sheets. Their use is explained on p. 148.

16. *Piece of Plate or Window Glass.*—On this the glue is spread when mounting and it should be about the size of your mounting sheets. 12 x 16 inches is one of the standard

sizes of window glass and will do very well for most specimens.

17. *Liquid Glue*.—Glue is the only mountant strong and lasting enough to be of much use in holding specimens permanently in place.

18. *Gummed Paper or Surgeon's Silk Isinglass Plaster*.—When a large number of plants or several similar ones have been identified, it is wise to attach name-tickets to their stems lest the names should be forgotten or confused before mounting. They can be easily affixed with strips of gummed paper and as easily removed. Some sort of adhesive strips should form part of every outfit, for they are useful in mounting. (See Chapter VIII.)

Gummed paper can be bought in sheets 17 x 22 inches for from 10 to 15 cents per sheet and also comes in strips and rolls. A better material for use in mounting plants, however, is silk isinglass plaster which can be bought of any druggist, in rolls 5 or 7 inches wide and a yard long, for from 60 to 75 cents. It is so much stronger and more adhesive than ordinary gummed paper that it can be used in

much smaller pieces; the expense is therefore not excessive and the effect neater.

Some botanists use nothing but adhesive strips in securing their specimens. It is not the best method, for the plants are not so well protected. Every leaf and tendril must be fastened down or the necessary moving of the mounts may break them off. The strip method, however, has certain advantages for collectors who keep their plants in albums as plants secured in this way may be moved to larger albums at any time.

19. *Labels*.—The name of each plant should be written on the bottom right-hand corner of the mount. This may be done upon the paper itself, or on a label with a printed heading, pasted on. Apply the paste only to the edges: this keeps the corners of the mounting-sheets from curling up, as they will do if the whole surface of the label is pasted over. The following is a simple form of label and 500 of them would cost about 75 cents at a good printer's.

HERBARIUM OF JOHN BROWN.

Collected by

In addition to the printed matter you should write on the label the name of the plant concerned, the sort of situation in which it grew—wood, field or swamp—, the place and date of collection and the name of the collector, if other than yourself, or your own initials. Thus, the label shown above, filled out, would read:—

HERBARIUM OF JOHN BROWN.

Hepatica triloba Chaix

Liverleaf

Open woods,

Concord, Mass., April 20, 1912

Collected by *J. B.*

To this may be added, if desired, the name of the family to which the plant belongs. It is not a bad plan to number each specimen and to

enter any notes you may have in regard to it in your note-book under the same number. The number of the page in your flora on which the plant is described may also be entered on the label. This furnishes a quick method of referring one to the other, very convenient when identifying two similar species or when questions are raised by fellow naturalists as to the correctness of your identification.

20. *Pair of Forceps*.—These are useful in mounting (See Chapter VIII) and in handling small parts of plants at all times. They can be bought of instrument dealers at 20 cents per pair.

21. *Case or Boxes for Storing Mounted Plants*.—When separate mounts are used they must be stored where there is no likelihood of dust or movement. The ideal case for an herbarium consists of tiers of large pigeon-holes, 12 x 17 x 5 or 6 inches, closed in front by a tightly fitting door. Such a case is, however, expensive. A very satisfactory substitute, especially for small collections, is found in stout card-board boxes, 12 x 17 x 4 inches in inside dimensions, covered with book-cloth and with

a drop front which allows you to draw out the specimens when wanted instead of lifting them out, and to take out any particular plant you may wish to examine without disturbing the rest. Such boxes, holding about 100 mounted specimens, may be bought ready-made from the Cambridge Botanical Supply Co. for 80 cents each. Very serviceable ones may be made at home from the folding boxes in which suits are sent out by clothing stores. These are about the right width and height; if too long, they can be cut down. Strengthen the corners by gluing on strips of book-cloth or the stout cloth used for lining trunks and dress-suit cases, cut down through the corners at one end for the drop front (the cover, when on, will hold it in place), put on an extra strip of cloth to reinforce the hinge, and you have a box which will last a considerable time if not roughly handled.

Name-cards should be pasted on the end of each box to show what it contains. New ones will have to be written and pasted on from time to time, for a growing collection requires occasional rearrangement.

Specimens may, of course, be kept in

drawers, but this is an awkward method if you have more than a very few, as it necessitates lifting out a whole pile of specimens every time you want to get at a particular one.

22. *Moth-balls*.—These may be bought for 10 cents per lb. at a druggist's, and one ball should be placed in each box, to prevent insects destroying the plants. No one who values a dainty collection will omit this item. I once saw an Ox-eye Daisy which had looked lovely when mounted, a complete wreck three months later. The disc was dropping to pieces, and tiny insects were scuttling away in all directions as if to hide their diminished heads from the light which was revealing their evil deeds!

The list below gives a cheaper and smaller outfit which will be useful to those who do not want a scientifically arranged collection.

1. Basket.
2. Scissors.
3. Old Tablespoon.
4. Supply of old Newspapers.
5. Mathews's *Field Book*, \$2.00; or Dana's *How to know the Wild Flowers*, \$2.00.

6. Some simple book on Plant Study (see p. 65).
7. Magnifying-glass.
8. Penknife.
9. Dissecting Needles.
10. Gummed Paper or Silk Surgeon's Plaster.
11. Home-made Press.
12. Drying-paper and Folders.
13. Small soft Paint Brush.
14. Cotton-wool or Wadding.
15. Album.
16. Moth-balls. (To be kept in the box or drawer where the Album is stored.)

A NATURE
NOTE-BOOK

“Flowers are the love songs—
 . . . of God’s green world.”

COULSON KERNAHAN.

“The old woods—how I have loved it. The sweetest memories of life are entwined back there among the grasses and the grapevines and the oaks and beeches. Its beauty and silence and the wild life in it were the unsolved mystery of boyhood, and its deeper study in later years has been a very great delight and inspiration. I think I gain, by familiarity with its life, something of its vitality, at least in spirit. The long vistas of the great trees, the sunshine mottling the leaves and filling the open spaces beneath with beautiful light, the immeasurable canopy and the shade, the birds singing their loves and their joys, the squirrels frisking among the acorns, and the atmosphere of age which pervades it, all have filled my mind with never-to-be-forgotten impressions of the beauty and loveliness of the old woods, and a memory abides that is a perpetual dream.”

PAUL GRISWOLD HUSTON, *Around an Old Homestead.*

CHAPTER III

A NATURE NOTE-BOOK

A necessity to students—Records of plant structure—Locality and date of “finds”—Your own observations—Drawings of plants—Various kinds of Nature Notes—Record of the months—Notes a reflection of yourself—The poetry of flowers.

I CAN imagine that some students may ask why the Nature Note-book—one item in the botanical outfit—should have a chapter to itself.

My reply is—because it is the most important item in that outfit; more important than your herbarium, if you mean to have one, and in a sense even more important than your Flora and other botanical works.

This Note-book is to be the record of the plants you find. It will contain not only the brief details of each plant given in the Flora, but the accumulated information about each that you gather from time to time from other books and magazines, and more important still,

it should receive the records of your own observations.

A Nature Note-book is a necessity to the earnest student, and by that I do not necessarily mean the leisured student. Greater leisure will of course mean fuller notes, but much may be done in odd minutes. Unless you have a most remarkable memory, some kind of record must be kept or you will lose much of all that you gain.

Pocket note-books are of little use. Their pages are narrow and few and so quickly filled that, instead of one or two books, you soon have a collection of a dozen or more which makes reference an irritating task. It is far better to have a thick exercise-book with stout card—or cloth-board covers. This will not cost more than 15 to 25 cents, and it will wear well, contain at least a hundred records, and the pages will be far more comfortable to write upon than niggling little ones measuring 2 by 4 in. You will require a page or more for the record of each plant, according to the amount of leisure you possess. A loose-leaf note-book is even better since it will allow you to keep together

all your notes on one plant, if they overflow the space you originally provided for them.

Suppose you have returned from a walk with half a dozen plants in your collecting-case. You will first of all examine and identify these by your Flora, and then will come the time for making notes.

Write the English name of the plant at the top of the page (and Latin also, if desired) and in addition the Family to which it belongs. The locality and the date should follow, with any details concerning the soil, environment, or the exact nook if the plant is at all uncommon. Chapter IV, on "How to Study Plant Life," will give you hints on their proper examination, and you will also find there a list of signs and abbreviations that will greatly reduce the labor of making notes. The usual order in which the parts of a plant are described in a Flora is as follows: Root, stem, leaves, flowers, fruit and seed. The same order should be maintained in the Nature Note-book. Hairs, bracts, thorns, stipules and other appendages also receive notice when present. It is not always necessary to abbreviate the

whole description to be found in the Flora, but the main points should be recorded. Afterwards you will add any abbreviated extracts from other books you may have, dealing with the plant under observation.

If you should have any illustration or magazine article describing the plant, the cutting should be neatly fastened into the book; or if you are an expert photographer and have a print of the plant or its locality, this will add still further interest to your Nature Notes.

A Nature Note-book should also contain rough sketches of the plants or some of their more important and characteristic parts. You may not be an artist, but practice will soon help you to do this far more quickly and easily than you would suppose possible. The sketches may be of the roughest description, but this will not matter. If you are an adept at rapid sketching you will soon draw in the whole plant with enlargements at its side of any special structural details you may wish to remember. If less practiced in this kind of work, you may content yourself with drawing only parts of the plant—possibly an example

each of the root, leaves, flowers, fruit and seed. If you have never done any drawing at all, take what flat organs the plant possesses, place them face downwards upon the page and follow their outline with a pencil. Leaves, some seed-vessels, and many sepals and petals may be treated in this manner. After lifting up the "model" the veining, spots, or other markings can be added to the drawing without much trouble. Stamens and pistils are usually very simple to draw, and you will soon get into the way of sketching flowers whose petals are united and irregularly shaped. The drawing may be colored with chalks or water-color paint if desired, but most students will be satisfied with a pencil outline and a small amount of "shading."

Those who prefer to make their sketches upon proper drawing- or painting-paper can easily paste these into the Note-book.

But whatever else your Nature Note-book does or does not contain, it must include the records of your own observations. The facts that a student discovers for himself are of the greatest value. You will find all kinds of de-

tails omitted by a Flora that will be of interest to yourself, for such books mainly undertake to give sufficient information to identify plants. You may notice hairs in the throat of a flower or on the stems or calyces, peculiarities of growth and structure, and many curious developments. Then, too, you should leave plenty of space for notes that may be inserted later about the same species. For example—suppose you make notes about a Jewelweed you have found flowering in summertime. Later in the year you will find specimens of the plant in fruit, and you will like to have some record of this, and perhaps a small sketch. Then when the winter is over and the bare earth has become green with innumerable seedlings, you will find in wet ground by springs and along brooks tiny plants bearing two nearly round, thick leaves very unlike those of the plant previously recorded. But other leaves of later growth show that the tiny things are seedling Jewelweeds. A seedling's first leaves are often strangely unlike those typical of the plant. Sometimes the second pair becomes at once very like the true leaves,

but quite as often the development is gradual and each fresh pair put forth becomes more like the typical leaf than the last. The Note-book should receive some record of the seedling stage, and if possible a sketch. Or you may prefer to preserve the seedling and mount it in your book.

I quite expect that some students may be groaning by now! "We are intensely interested in plant life," they will say, "but we have other duties in life beside the keeping of a Nature Note-book. How are we to find time for all these notes and sketches? Identification often takes a beginner a long time, and we learn that the preservation of plants demands care and patience. If we spend time on notes we shall make such slow progress!"

Ah, that is just where you make such a mistake. Your great idea of botanical knowledge is knowing the names of as many plants as possible, and reading up the details of their structure—and forgetting these details almost as quickly; though you will not own to this part of the story!

Now let me advise you. When you bring

large bunches of flowers back from your rambles, do not attempt to identify, to preserve, or to make notes of them all, or even of one quarter of them. Take the rarest in the bunch, two, or at most three plants in a day, and study these properly. Then if time permits of your examining others at a later hour, do so, but preserve fresh examples some other day, as plants that have stood long in water are unsuitable for the press. Learn to study a few plants thoroughly. Do not be in a hurry to know all at once.

A Nature Note-book may contain chatty memoranda of scenery, picnic and rambling party episodes, and any other details that help to make a book intensely interesting and alive. Such records vary as infinitely as their writers. It rests with yourself as to the kind your own shall be. Whatever they are they will be a reflection of yourself. You will be unable to prevent this.

If you are sternly matter-of-fact the book will be a practical, business-like record of names and places and dates, with short, crisp details of floral structure—no more, no less.

Everything that should be there will be there, but there will be no suggestion of what you would call "padding." Neat little drawings may be scattered about and short extracts and magazine cuttings will be carefully pasted in, but all will be as practical as a catalogue of farm implements. As for the book itself, this will be bound in some dark, useful color (how you like that phrase, "some dark, useful color"!), that will not show soil and wear.

If, on the other hand, you are at heart a poet or an artist you will not be able to keep the fact out of such a book as this. Perhaps even the binding will be beautiful. You will choose some glorious, glowing color, some rich, soft cardinal or blue such as the Pre-Raphaelite painters loved, and so make your Nature Note-book all lovely within and without. As for the notes themselves, they will become a diary of the months, a record of the beauty you have seen and reveled in. They will include something beyond structural details, sketches and cuttings from magazines, for the pages will be scattered over with photographs, showing not only the chief beauties of the places you have

seen but the lovely little nooks and corners where wind-flowers nestle and violets and ferns and other shy things hide. Or there may be pictures of wayside resting-places where you halted to examine your "finds," and perhaps here and there a lively picnic group. Without trespassing on ground that rightly belongs to the Diary, your records will be intensely human. There will be references to the places visited, the scenery, the weather, the route taken, the rambling party, and the friendships formed among the flowers.

You will find that the books you read are scattered over with references to flowers, to outdoor life and color effects—references which you had passed over as mere fanciful descriptions, until your eyes were opened to the glory of their reality. Some of these word-pictures will so exactly describe the haunts you love that you will copy them into your Note-book, with many a poem in verse as well.

As you wander in the fields, by the stream-banks, or upon the wide stretches of moorland, poetry will more and more weave itself into your thoughts, and you will go back to

poetry to find the pages scattered over with flowers.

The capacity to enjoy color and the mysterious beauty of changing light increases as the months go by. You will not only note the color of one tiny Harebell but your Nature Notes will be so written that whenever you read them you will see again the open hillside or the steep and rocky bank, blue with the most elusive blue in Nature. You will see the fragile flowers bending to the sweeping wind and swinging in the gentle breezes until again you almost hold your breath to catch their magic tinkle. You never did quite catch the sound, did you? The world was never quite still enough; but as you held the lovely bells and peeped into their wonderful chalice depths, surely the music of Browning's poetry rang in your ears—

“And her eyes are dark and humid like the depth on
depth of lustre
Hid i' the harebell.”

And you will never see Harebells again without remembering how Browning saw them and set his thoughts to music.

HOW
TO STUDY
PLANT LIFE

“What! dull, when you do not know what gives its loveliness of form to the lily, its depth of colour to the violet, its fragrance to the rose; . . . when earth, air, and water are all alike mysteries to you, . . . while all the time Nature is inviting you to talk earnestly with her! . . . Go away, man; learn something, do something, understand something, and let me hear no more of your dullness.”

SIR ARTHUR HELPS.

HYMN TO THE FLOWERS

“ ’Neath cloistered boughs, each floral bell that swingeth
And tolls its perfume on the passing air,
Makes Sabbath in the fields, and ever ringeth
A call to prayer.

Your voiceless lips, O Flowers, are living preachers,
Each cup a pulpit, and each leaf a book,
Supplying to my fancy numerous teachers
From loneliest nook.

Were I, O God, in churchless lands remaining,
Far from all voice of teachers or divines;
My soul would find, in Flowers of Thy ordaining,
Priests, sermons, shrines!”

HORACE SMITH.

CHAPTER IV

HOW TO STUDY PLANT LIFE

“How can I study plant life?”—Confusing number of books on the subject—A simple beginning—Best way of learning meanings of technical terms—A first lesson in plant study—Tall Buttercup—Floral mechanism of Robin’s Plantain—List of abbreviations used in notes—Useful books for further study—Attempting too much—The botanical bore—The interesting botanist—The use of English names.

“How am I to study plant life?” “What books should I buy?” “How may I learn something beyond the names of the plants I find?”

These are the questions that every would-be botanist asks, and years ago it would have been easier to reply, as books suitable for amateurs were few and far between. Nowadays the market is flooded with botanical works of all kinds, from elaborate and expensive Floras to the chatty little “guides” that go so easily into one’s pocket. There are books on the haunts

of flowers, their structural development and their relation to the insect world; books on poisonous and carnivorous plants, and many treatises on the geological antiquity, geographical range, and general life-history of plants. Every year fresh wonders are discovered, more questions are answered, and yet more are being asked. But in spite of the vastness of the subject and the large amount of literature dealing with it, the student need not be discouraged. His chief difficulty will be to find a single book, or two or three, which will give him just the information he wants.

The best plan is to begin very simply. If you do not intend to preserve your "finds" you need only buy two books, a note-book, penknife, and magnifying-glass, for most people already possess the remaining requisites (a basket, pair of scissors, trowel, old newspapers, needles and pencil) mentioned in a former chapter on "The Botanical Outfit." One of the two books should be a well illustrated Flora (see p. 29), and the other some simple work on plant study.

Neltje Blanchan's *Nature's Garden*

(Doubleday, Page & Co., New York, \$3.00) will probably furnish more than any other single book of what you will want to know about our common flowers—their fertilization and the ways in which insects assist in it, and the devices by means of which they hold their own in the struggle for existence. The book contains illustrations, from photographs, of about 125 species, nearly half of them colored, and brief descriptions of many more; and it may be used, to some extent, as a flora, since the plants are arranged in it according to color and time of flowering.

If you intend to preserve specimens of the plants you find you will need a botanical press and a few other things which are fully discussed and explained in Chapter II. I strongly advise all students to form such a collection of plants. It makes a lovely memento of the years, especially of holiday times, and though the work of preservation requires care and an average amount of patience, it is quite simple and intensely interesting. Perhaps the strongest argument in favor of the herbarium is its educational and artistic

value to yourself and your friends. If you preserve your plants you have something to show for your study, something tangible and delightful, something which will be of lasting value to yourself and at once arouse interest in other people. No photograph or colored plate, however lovely, can ever equal the interest and value of a real plant naturally and carefully preserved. But you must remember that plant preservation is an Art. For this reason I am giving full details of the process in the two chapters on Pressing and Mounting Plants. If you carry out the instructions you will find that comparatively few of your flowers will fade or seriously change color.

To return to the general study of plant life—there are a few technical terms that confront the student in the simplest books, so that a little time should be given to the study of such words as sepals, petals, stamens, pistil and pollen. You will find them fully explained in the illustrated Glossary (Chapter IX of the present work).

If you are ignorant of the names given to

most plant organs, take some well-known flower and study it with the help of this Glossary. You will find yourself rapidly becoming familiar with the chief botanical terms; but you must have the living plant in your hand or your progress will be slow; you must have an actual example before you or the terms and their explanations will be mere dry lists with no more romance in them than the dictionary holds for those uninterested in philology.

FIRST LESSONS IN PLANT STUDY

EXERCISE I.

Having bought your small stock-in-trade, go into the fields and uproot two or three Tall Buttercups. You may distinguish these from all similar species by their leaves. They are cut into three main divisions, which are again variously cleft, and none of these divisions has any stalk. All our other buttercups with divided leaves have at least one of the parts stalked. Bring the plants home and compare them with Plate II. At the base you have the fibrous root, next the stem surrounded by radical or root-leaves. Higher up, and springing

from the stem, are the cauline or stem-leaves, generally simpler than those that spring directly from the root. Higher still are the flowers, and on examining one of these you will find five little green leaves called sepals (collectively the calyx), and five large golden petals (collectively the corolla). Within this corolla are clusters of golden threads called stamens, and in the center a number of greenish-yellow carpels (collectively the pistil), each containing the seed of a future plant.

EXERCISE II.

After carefully examining the plants, make a drawing of one in your Nature Note-book, which should be bound in cloth and of exercise-book shape. Never mind how badly you draw or how humble the result—draw the plant and mark its parts from memory exactly as they are noted in Plate II. Shade the sepals to distinguish these from the corolla, or roughly indicate the coloring of the whole plant with colored chalks. The drawing is intended to be more a diagram than a picture, so that the plant should be posed to show structural de-

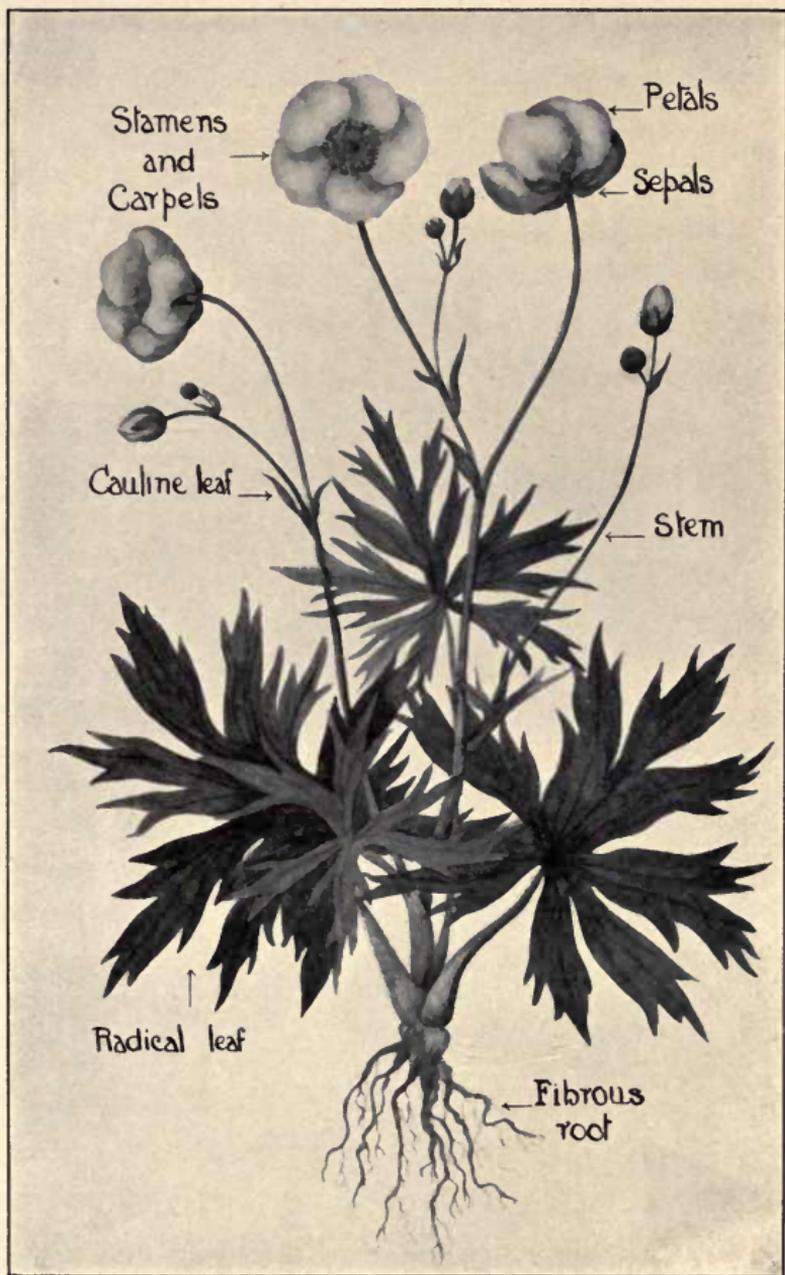


PLATE II.—TALL BUTTERCUP.

tails rather than graceful lines and good pictorial composition.

EXERCISE III.

Take a flower to pieces and draw an example of each part, or whorl. The parts should be separated with the thumb and the blade of a sharp penknife.

EXERCISE IV.

Look up Tall Buttercup in your Flora and study its full description with the plant in your hand. If you are using Mathews's *Field Book* you will find its description on p. 144.

EXERCISE V.

Write (immediately below your rough sketches of the plant) the chief items of interest connected with it. Such an entry might run as follows:—"Tall Buttercup, *Ranunculus acris*—Family Ranunculaceæ. (Here would follow the date and place of finding.) Fibrous root; erect, unfurrowed stem; some leaves springing from the root, others from the stem; lower leaves three-lobed, each lobe again divided; upper leaves generally simpler; flowers

of regular shape, 5 spreading green sepals, 5 large yellow petals, many stamens and carpels."

You would add to the above paragraph anything further you had learned from *Nature's Garden* about this particular plant or the characteristics of its Family.

EXERCISE VI.

If you wish to preserve your specimens the remaining plants should now be pressed. Full directions for doing this are given in Chapter VII. Chapter II, on "The Botanical Outfit," will tell you all you will need in the way of a press and drying-sheets.

So far for your first lesson in plant study. You must now take special notice of Buttercups whenever you see any. You will soon discover slight differences between those you have examined and others that appear to be very similar at first sight. You may find, usually in wet or moist shady places, a buttercup which has the divisions or segments of the root-leaves both longer and broader than in your first plant and at least the central one stalked.

Also, the stems are often weak and lie nearly flat along the ground, and if you look at the center of the flower through your magnifying-glass you will see that each carpel is tipped with a long, nearly straight spur or point, whereas those of your first plant had short, hooked points. This is the Swamp Buttercup, *Ranunculus septentrionalis*. If you live in New England, you will probably find also the Bulbous Buttercup with furrowed flower-stalks, thick, bulb-like root and radical leaves with shorter, broader segments than in either of the others. Further west may be found the Early Buttercup, *Ranunculus hispidus*, with root-leaves similar to the last, though less divided, but with only fibrous roots and with narrower, paler yellow petals.

When you succeed in finding any two of these plants, **Lessons II and III** should be the study of Bulbous or Early and Swamp Buttercups, worked out in six exercises each, after the style of Lesson I.

You will find the Tall Buttercups changing as the days and weeks go by. One by one they shed sepals, petals, and stamens, and the car-

pels gradually ripen and enlarge until at last these too are dispersed, and each little seed goes off to start life on its own account. You should secure a cluster of ripening carpels and make a separate sketch of these and also of a single carpel as it looks when magnified. This sketch may come at the side of the former drawing. Gather and sketch the fruit of the two other species so that you may compare them with each other and know your plants well in every stage of their existence.

The prettily named Robin's Plantain goes so naturally with Buttercups that it shall be the subject of study for

LESSON IV

Uproot two or three plants in good flower; shake the earth free from the roots and bring all home for examination.

EXERCISE I.

Here we have fibrous roots again (see Plate III, Fig. 1). Runners are also given off, which root and form fresh plants, and these produce, in the fall, small rosettes of leaves

which, lying close to the ground, live over the winter and make it possible for the plant to bloom early in the following spring. There is a cluster of leaves at the base of the stem and these are toothed at the upper end; but higher up the stem the leaves are entire—that is, not cut into in any way. The stems are more or less hairy, and on coming to the “flowers” themselves we find them entirely different from the simplicity of the Buttercups. At first sight you may have thought the tiny, green leaf-like objects close under the “flower” were sepals, the pale bluish-purple ray a ring of petals, and the golden center a dense mass of stamens with, perhaps, some pistil hidden away somewhere. But directly you begin to examine the “flower,” to pull it to pieces and look at it under your magnifying-glass, you find that this theory will not work at all! The plant is far more complex than you had imagined. Pulling out one of the rays, holding it by a dissecting-needle and placing it under the magnifying-glass, you discover it to be a flower in itself, entirely different from the complete flower and the regular shape of the Buttercup,

but, nevertheless, a separate flower. You make a similar discovery on examining one of the yellow objects you had thought to be stamens. It also is a miniature flower in itself. The corolla is tubular, opening into five lobes at the mouth and you can see the pistil and the stamens within.

The Robin's Plantain is a compound or composite flower. It is a flower-colony, and we speak of these flower-colonies as flower-heads.

Having discovered something of what the Robin's Plantain is and is not, it should now be examined more perfectly.

EXERCISE II.

Cut off a flower-head, place it upside down on the table and with a sharp penknife cut down through the short length of stalk to the apex of the yellow disc, so that you divide the floral colony into halves, as in Plate III, Fig. 2. Clustering beneath the flower-head are rings of leaf-like objects that resemble sepals. They are not called the calyx, however, for that term is reserved for the cup that preserves a single flower. They are called bracts (Fig. 3),

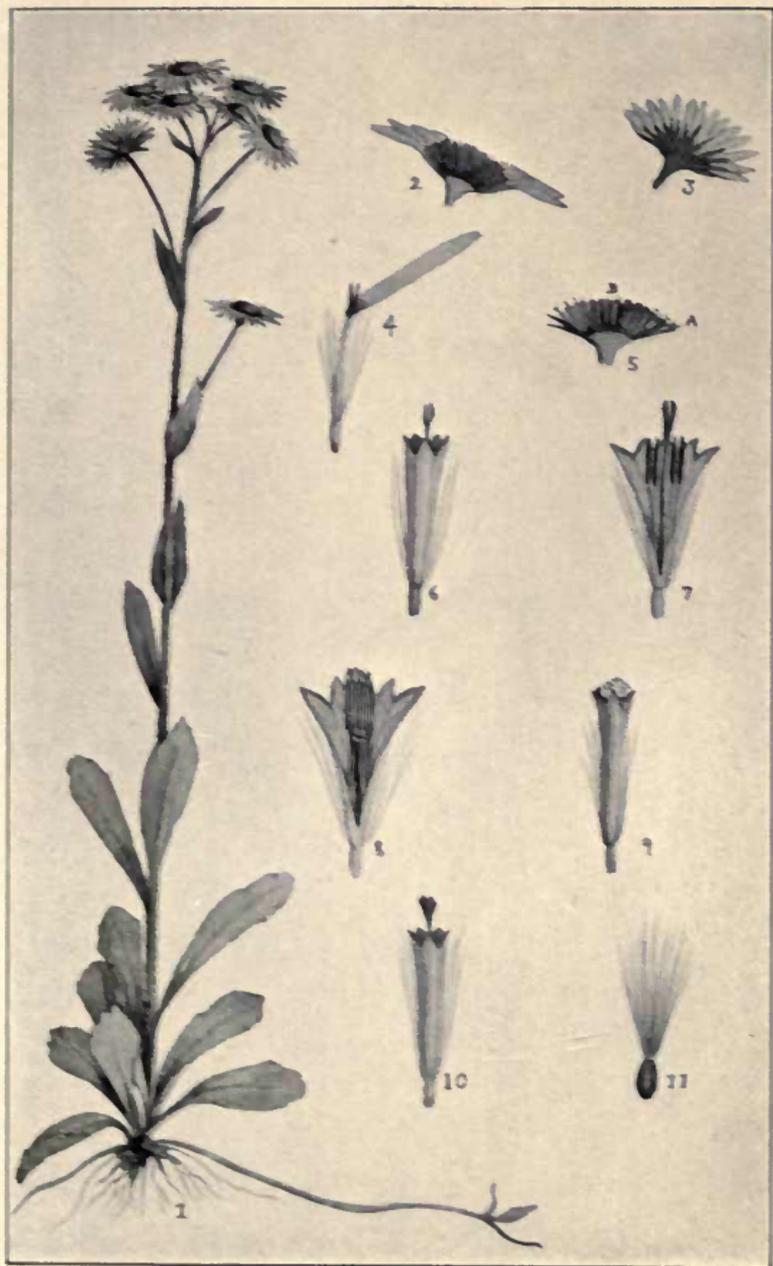


PLATE III.—ROBIN'S PLANTAIN, WITH VARIOUS PARTS ENLARGED.
(Drawn by Una L. Foster.)

collectively the involucre (see p. 162). Pull off several bracts so that you may remove a few ray flowers, or florets, easily and without injury. The corolla is strap-shaped for half of its length (Fig. 4), but near the middle its edges unite to form a tube. This is surrounded by a ring of long hairs which grow from its base—the strangely transformed calyx of the floret. From the tube peeps the tiny pistil with its two branches, or arms, called stigmas. There are no stamens, so these purple ray florets are imperfect and cannot of themselves produce seed. You will probably ask why they should exist; but imagine how insignificant and unattractive the flower-head would look without them. They are not useless, for even though they should not produce seed, they attract insects to the seed-producing yellow florets of the disc. They act as flags, and so serve a most useful purpose.

Some plants are fertilized by their own pollen, others either occasionally or invariably require pollen from other flowers of the same species before good seed can be set. This pollen is conveyed from plant to plant chiefly

by the wind and insects. Wind-fertilized flowers are generally insignificant in size and color and without perfume. Those fertilized by insects are usually large or conspicuously colored, but if small they are massed together in bunches or colonies like the plant under present discussion. They are generally sweetly or disagreeably scented according to the kind of insect they wish to attract, which is also the kind of insect best adapted to effect their fertilization. You will find further information on the subject of fertilization on p. 169.

We turn now to the golden disc florets, which are arranged on a cushion-like receptacle (Fig. 5), which gives room for all to expand. If you look carefully you will see that the florets near the circumference of the disc (Fig. 5A) are more fully open and matured than those in and near the center (B). They take it in turns to ripen, those at the edge always having "first turn," while the central florets bow politely to their elders with a courteous "*Après vous!*"

Examine one of the ripest florets under the

magnifying-glass. The wee corolla (Fig. 6) has five petals united in a tube, except where they divide at the mouth and, like the ray-florets, is surrounded by a ring of hairs. On cutting the floret open you will find that the five stamens sit on the walls of this corolla tube (Fig. 7), and as the edges of their anthers adhere they themselves form a tube. You must take special notice of this, for it is a characteristic of the Compositæ, or Family of Composite Plants. There is another family known as Dipsacaceæ (including the well-known Teasel) which consists of compound flowers with no such tube.

We come now to the pistil, which (as you have learnt from the Glossary) consists of stigma, style, and ovary. I want you to look first into an unripe floret. When the corolla tube is cut open and examined under a microscope it looks like the sketch at Fig. 8, Plate III. Your glass may not show this so clearly but you will distinguish the anthers clasping the stigma.

Now take a floret rather farther from the center of the disc, but do not open it. The

anthers have shed their golden pollen dust, and the pistil's style has lengthened so that the little stigma has pushed the pollen up to the mouth of the corolla tube, where insects may easily find and carry it off to other robin's plantain flowers (see Fig. 9). You must now take a third floret still farther from the center of the disc. "What's happened?" you ask. The pollen has gone, the stigma seems to have gone too (Fig. 10); but in its place two arms are outspread, two stigmas instead of one. There always were two stigmas, but they were folded together like hands, palm to palm, and the sticky, stigmatic surface was inside. This elaborate floral mechanism ensures cross-fertilization, and prevents or lessens the chance of self-fertilization. As long as the floret's own pollen was within the corolla tube the stigmatic surfaces were enclosed and protected. To enable insects to gain access to this pollen and to carry it off to other flowers the style lengthened, and the protected stigmas pushed it up and out as a sweep's brush pushes soot out from the chimney. Then when the pollen had been carried away came the pistil's turn, and

the stigmas opened out to catch any pollen that insects might drop after visiting younger florets.

After fertilization the ray florets wither and the corollas, stamens, and stigmas of the disc gradually fade and fall off, for they have fulfilled their purpose, and the little seeds, or more properly achenes, are left, each crowned with its plume of tawny hairs (Fig. 11). As the receptacle dries, their attachment becomes looser until at last they are entirely free and ready to be carried off by any passing breeze—the plume of hairs acting like a little parachute to assist in this process—and to begin life for themselves.

EXERCISE III.

Make a rough drawing of a Robin's Plantain, including the root, runners, lower leaves, flower-stems, and flower-heads, marking each (from memory) after the style of Plate III.

EXERCISE IV.

Draw the following parts of the plant several times their exact size, using the magnify-

ing-glass to make all clear:—Flower-head cut through from stem to the apex of the disc, single bracts, one ray floret, disc florets in three stages, and a mature flower-head after the withering of the ray florets, showing the achenes with their plumes of hair.

EXERCISE V.

Study the description of the Robin's Plantain given in the Flora and write down a shortened and simplified form of this in your notebook, adding to the paragraph anything further that you learn from *Nature's Garden* either about the Robin's Plantain itself or the characteristics of its Family.

EXERCISE VI.

Preserve two plants by arranging them very carefully in a press, and using blotting-paper and wadding circular pads for equalizing pressure round the flower-heads (see p. 130).

Every plant found should be examined and described according to the method suggested in these exercises. If you have very little leisure, sketch only the peculiar characteristics

of each plant; but there must always be careful examination and dissection and some record kept of this. Busy students will readily invent time-saving contrivances in the way of signs, symbols, and abbreviations for constantly recurring terms. The following suggestions will reduce the work of making notes to a very short and simple process.

<i>R.</i> = root	<i>Cor.</i> = corolla
<i>St.</i> = stem	<i>P.</i> = petals
<i>L.</i> = leaves	<i>Sta.</i> = stamens
<i>Fl.</i> = flowers	<i>Pt.</i> = pistil
<i>Fst.</i> = flower-stems	√ = stigma
<i>Fh.</i> = flower-heads	= style
<i>C.</i> = calyx	<i>O.</i> = ovary
<i>S.</i> = sepals	<i>Fr.</i> = fruit

After working for a few months with *Nature's Garden*, students may add to their botanical library; but in buying new books it is necessary to take care that the subjects do not overlap too much. It is distinctly trying to find two books giving exactly the same information, and only differing in general style and in the presentation of the facts. All works on plant life must have something in common, but each new book bought should be chosen with

the idea of widening and deepening present knowledge, and not of reiterating what has been already learnt.

It is safe to say that no one has made natural history more attractive than did William Hamilton Gibson. In the botanical parts of his three volumes (*Eye-Spy, My Studio Neighbors* and *Sharp Eyes*, Harper & Bros., New York, \$2.50 each) are to be found many interesting observations on plants and their ways, charmingly told and still more charmingly illustrated. They tell of the fertilization of different flowers and the insects which accomplish it, the behavior of tendrils, seedlings, pollen-grains, seed dispersal, etc. And, perhaps best of all, they will show you what to look for in your own observations of plants which they do not describe. Another altogether excellent little book is Clarence Moores Weed's *Ten New England Blossoms and their Insect Visitors* (Houghton, Mifflin & Co., Boston, \$1.25). The title modestly mentions only ten flowers but almost three times as many, nearly all different from those in Gibson's

books, are described with reference to methods of fertilization, devices for protection against their enemies and their origin and development in past ages. This book, too, will show the way for your own observations.

Doubtless you will want, in time, a wider and deeper knowledge of the life history of plants. A good and pleasantly written popular book along this line is Maud Going's *Field, Forest and Wayside Flowers* (Baker & Taylor Co., \$1.50). This takes up subjects suggested by the plants in the order in which they appear during the season, such as the flowers, buds and fruit of spring trees; the leaves, their structure and the work they do for the plant; the structure of stems; climbing plants; the life history of ferns; evergreen trees; the fall of the leaves in autumn; and the winter resting of plants. Unlike most popular books, it contains chapters on grasses and sedges and their interesting floral structures, but unconsciously furnishes an illustration of the reason why these families are usually left out—for both the species of sedge pictured are wrongly

named! The book has over 100 illustrations and refers to more of our own native plants than most general works.

A valuable book is *The Living Plant* by Professor William F. Ganong of Smith College (Henry Holt & Co., New York, \$3.50). It has the unusual advantage of having been written by a thoroughly competent scientist especially for persons interested in botany but with little technical knowledge of it. The author uses some technical terms because they furnish often the only method of saying briefly exactly what one means; but such terms are carefully explained. You may want to read the book backward, for it begins with an account of the cells of plants and their work, something very wonderful but which you cannot see for yourself without a compound microscope and skill in using it, and only in the middle do you reach a treatment of such subjects as the movements of plants, their devices for reproduction and other things which you can see for yourself. But whichever way you read it, you will find it worth reading and when you have finished, you will have a very complete summary of what is

known about the life of plants. Another work which covers much the same ground is Knight and Step's *Popular Botany* (Henry Holt & Co., New York, 2 vols., \$5.00). It has a more popular style and in some instances goes more into detail than does Ganong's book; but it is not so well written and arranged. It is, however, interesting for its more than 700 beautiful illustrations from photographs which include many American plants.

These books make a good beginning for a botanical library. As you go on, you will doubtless want to add more according to your taste and capacity and the money at your command. There are many attractive books and new ones are constantly appearing. Ganong's book is of value here because of its suggestions for further reading along different lines.

In studying plant life the student must guard against attempting too much in a day or in any one season. Few people have very much leisure, so that it is far better to examine a few plants thoroughly, to know twenty really well, and to have an interesting record of them in your note-book, than to have such a cursory

knowledge of a hundred that you are continually confusing the names of similar species, wondering why two plants may not share the same name, and inveighing against the "muddlesomeness" of botany in general!

Nature is never in a hurry. Learn from her how to "make haste slowly!"

I want to give you one more little hint before bringing this chapter to its close.

A botanist ought to be a fascinating companion and one of the most entertaining of guests at picnic and rambling parties, but—just occasionally—he is nothing of the sort! He is, instead, a most inexpressible bore! Most of us have met such a person. He positively hurls knowledge at the heads of *les autres* and pours forth torrents of Latin at the least provocation. Please do not develop into anything so objectionable, will you?

The average person has no wish to know the Latin names of the plants he finds. He does not care an atom whether "the thing" has five or three styles—"whatever styles may be"—or how this important matter of its wealth in styles distinguishes it from its less

avored relation. He is not on bowing terms with its relation, and he regards this type of gratis information as just one degree more boring than Mrs. Brown's recital of how her "sister's husband's step-brother married Mrs. Smith's cousin, Susan Ellen Robinson as-was." Neither statement leaves him with a thirst for further knowledge!

Unless you are chatting with botanists, tell your friends the English names only of the plants they find, for these are easily remembered. Do not worry people with numbers and parts, for they are usually as ignorant of plant organs as you were yourself a few months or years ago! Tell, instead, any interesting story you know of the plant's method of reproducing itself; its wonderful plan for self-fertilization, or for preventing this and securing cross-fertilization; but tell all this in the simple, chatty, unaffected manner that invites questions. Avoid technical terms as much as you can, and when asked a question you cannot answer—own up and say you do not know!

GATHERING
WILD
FLOWERS

“For of all things there is none so sweet as sweet air—
Sweetest of all things is wild-flower air.”

RICHARD JEFFERIES.

“O the gleesome saunter over fields and hillsides!
The leaves and flowers of the commonest weeds, the
moist fresh stillness of the woods,
The exquisite smell of the earth at daybreak, and all
through the forenoon.”

WALT WHITMAN.

CHAPTER V

GATHERING WILD FLOWERS

Use of basket or collecting case—Choosing a specimen for preservation—Wanton and destructive gathering—Only a few of each species to be picked.

THERE is an art in picking flowers as there is in the doing of most other things; and if plants are to look dainty and natural when mounted they must be gathered in the right way.

Never carry them in your hands if you can avoid this, for wild flowers wither so quickly and their leaves and stems are in danger of being crushed. A collecting case or a basket should be used instead (see p. 27), and the plants must not be too much crowded in this or they will be damaged. Plants keep better, however, in a case moderately well filled, than in a nearly empty one.

When choosing specimens for preservation, remember the size of your mounts. It is far

better to have a small but complete specimen than a large one cut down to the required size and showing nothing but a huge cluster of flowers or fruit, six inches of sturdy stalk, and close to its cut end one or two little leaves, too small and immature to show the characteristic shape. (See Plates IV and V.) Great Willow-herb is a good instance of a plant that may be found quite small and low growing, although its average height is 3 ft. to 4 ft. and giants of over 5 ft. are occasionally seen.

All plants, however, are not so accommodating, and in such cases a few inches must be cut out from the stems a little beneath the flower or upper leaves. This will show the characteristic growth while adapting the plant to the size of the mount. This method should never be employed, however, when smaller and complete specimens can be found, for it takes away from the natural appearance of the plants.

A pair of scissors should be used for cutting all thick and obstinate stems, for tearing at a plant not only spoils the part that is picked and chafes the hand, but it injures the sur-

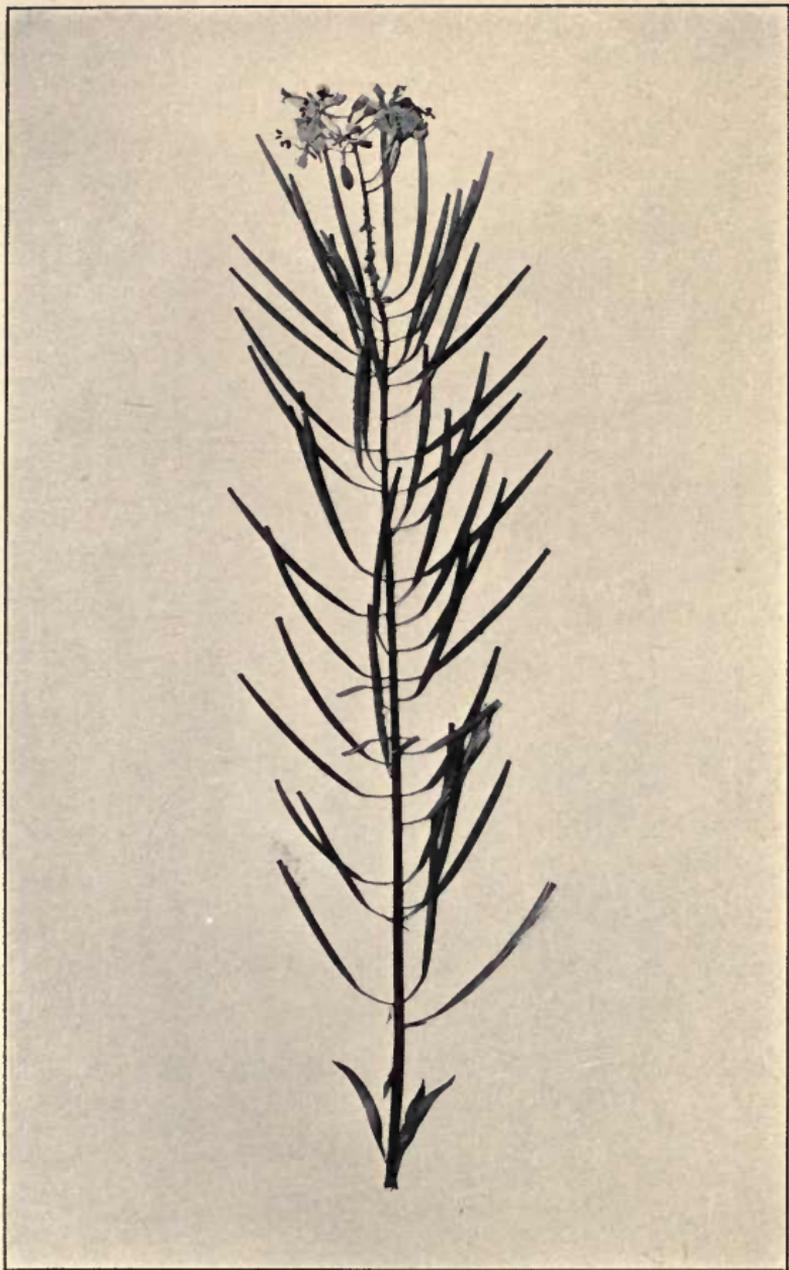


PLATE IV.—GREAT WILLOW-HERB.

A poor specimen for preservation.

(From a photograph.)



PLATE V.—GREAT WILLOW-HERB.

A good specimen for preservation.

(Photographed from the herbarium of Charles H. Bissell.)

rounding growth and loosens the roots. Many plants are so lightly fastened in the earth that the slightest pull uproots them.

Too much cannot be said against greedy and destructive gathering. The true naturalist picks a plant carefully, measuring with the eye the length of stem that can be accommodated in the press, and cutting it off at that point.

A really complete specimen should show root, stem, leaves, buds, and flowers. When the fruit matures rapidly examples may often be found on the same branch as the buds, and such plants should be chosen for the herbarium; but in most cases specimens of the plant in fruit have to be gathered and preserved later. It is quite easy to include the roots of small plants, such as Violets and Anemones. The roots of taller plants must be cut off and mounted at the side of the main portion. Some botanists do not preserve the roots of their plants. Roots are a little awkward in the press, but if treated like all other knobby parts of plants they may be mounted very successfully (see p. 127). If not included in

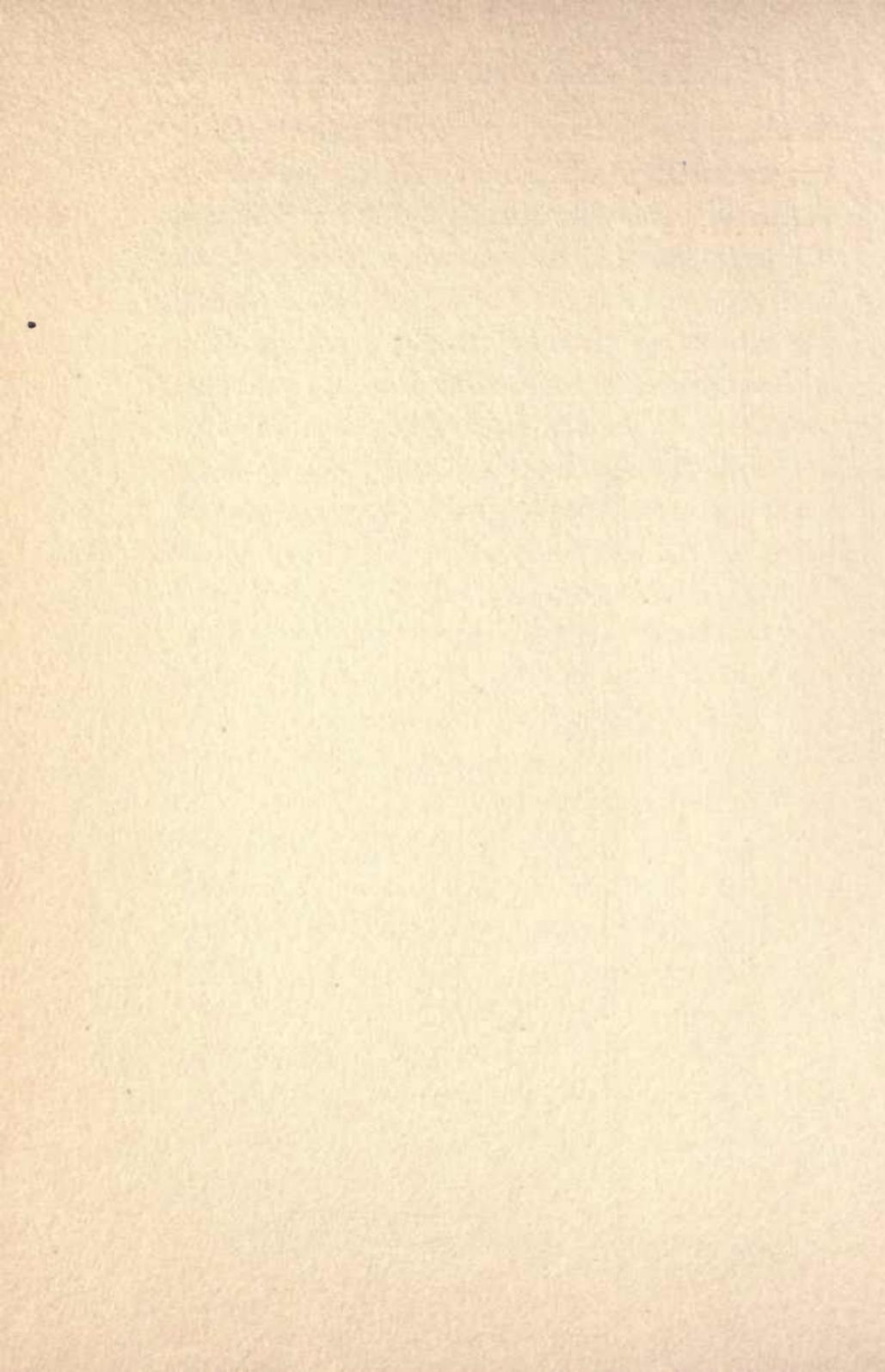
the herbarium, roots must be dug up and studied and examined, or your knowledge of plants will be very incomplete; *but the roots of rare species should on no account be disturbed.*

Never tear up handfuls of plants to choose out the best afterwards and throw the remainder away; and please do not pick a bunch of grass because some coy little flower is hiding in the middle of it! This really is not "playing the game."

Do not aim at mounting as many plants as possible in your first season. It is hard to resist such a temptation, but it must be overcome if disappointment is to be avoided. The average botanist has too many other duties to be free to devote a great deal of time to pressing flowers; and if a number of plants are hurriedly pressed, simply because they are there to be pressed, the result will be extremely dismal. At the end of a few months you will have decided that half this book is pure rubbish! It is small comfort to have a hundred specimens in the herbarium if only thirty are recognizable and only ten really beautiful.

I have now warned you; and after finding out the truth of all I have said by one or two obstinate little experiments (for I know you will experiment), perhaps you will settle down to "do as you are bid" and pick fewer plants, devoting more time to careful pressing.

You will have your reward as the years go by, for each holiday by the sea, on the hills, or among the country lanes will give you some floral memento that may remain "a thing of beauty and a joy forever."



THE
IDENTIFICATION
OF PLANTS

“One is never thoroughly sociable with flowers till they are naturalized, as it were, christened, provided with decent, homely, well-wearing English names.”

MARY RUSSELL MITFORD, *Our Village*.

“The Cowslip startles in meadows green,
The Buttercup catches the sun in its chalice,
And there’s never a leaf or a blade too mean
To be some happy creature’s palace.

No matter how barren the past may have been,
’Tis enough for us now that the leaves are green ;
We sit in the warm shade and feel right well
How the sap creeps up and the blossoms swell ;
We may shut our eyes, but we cannot help knowing
That skies are clear and grasses growing.”

JAMES RUSSELL LOWELL.

CHAPTER VI

THE IDENTIFICATION OF PLANTS

Early identification—Difficulty of identifying many after pressing—Examination of the Cuckoo Flower—Scientific methods of identification useless to beginners—An examination of Mathews's *Field Book*—A popular and simple method of classification—Example of plant description.

WILD flowers should be identified as soon as possible after gathering for they wither very quickly. If your Flora is of portable size, take it into the fields and lanes and identify your plants under the blue sky. There you can compare any number of examples with the printed descriptions; you can verify every detail in each example; and the plant's mode of growth will impress itself more vividly upon your mind. Flower-books, too, seem less learned and terrifying when studied in the open air, and tiny penciled notes may be jotted in their margins telling where and when you found the plants, so that the pages become rich

with associations and sunny memories. Some people's Floras seem dedicated to indoor study only, and when such students pore over them it is with frowning brows and rumpled hair! The books, too, are stained with ink and they smell fusty. Now, if a Flora is stained at all, it ought to be with green juice and pollen dust and not with anything so prosaic as ink!

If you love Nature you will spend every possible moment in her presence; and on still, warm days both identification and pressing can be done in the fields. An extra stock of drying-paper should be strapped with the Flora and paint-brush to the side of the press, and the scissors and magnifying-glass can go in the basket. When the press contains plants that are dry enough for mounting, these should be removed before starting for another flower-hunting expedition.

For obvious reasons, plants will most frequently have to be identified indoors. If you use a collecting case, they will, if sprinkled with a little water, keep fresh in it for several hours or even a day or two. But if brought in a basket, they should be placed in jars of

water *immediately* you enter the house. If left for half an hour, especially after a long tramp, you will find them limp and wilted. Jars are preferable to bowls, as they give greater support to the stems, and as fruit jars are usually plentiful, do not be stingy in this respect but use a liberal number, putting a few plants only into each. This is not fussiness. You must remember that every error, from picking to mounting, will show itself in the mounted specimen. If you have torn the stem-leaves off in gathering, the wound will show. If the plant has been crowded in the basket or in the water-jar, or allowed to remain without water too long, it will rarely be worth mounting at all. It will look what it is—an exhausted plant, crumpled and dying and miserable. The jars should contain very little water, sufficient to cover only one inch of each stalk. Wet plants are dangerous in the press, for they cause mildew. As soon as the plants are arranged in the jars, place them upon a table in a good light, with your Flora, notebook, magnifying-glass, penknife and dissecting-needles at hand.

Plants are most easily identified when fresh and it is better to do it then if possible, but flowers and other parts of pressed plants become soft and take on their natural shapes again if plunged for a few seconds into boiling water, and can then be dissected and examined. If you are going to do this, you should provide some extra material when pressing your finds, so as to leave an undamaged specimen for your herbarium.

HOW TO EXAMINE A PLANT.

When identifying plants the flowers should be carefully dissected, and every organ examined through the magnifying-glass and compared with the plates and descriptions in the Flora. *You cannot really know a plant until you have done this.*

The Frontispiece will show you the various stages in the examination of the Cuckoo Flower (*Cardamine pratensis*)—a very good and typical example of the Cress Family. To begin with, you have the entire plant, showing its root (1) and the arrangement of its two kinds of leaves, radical (springing directly

from the root) (2) and cauline (springing from the stems) (3). You can see (at 4) how the flowers are arranged on the stems and that each has a separate stalk of its own (5). Cut off one of these flowers and examine it separately, both with the naked eye and through the magnifying-glass (6 and 7). Its four sepals must be removed by the thumb and knife-blade. You will see that two of these sepals are pouched at the base (8). The long "claws" of the petals (or stalked portions) are now left unprotected (9), and if pressed open on a sheet of paper their crucifer arrangement is very distinct (10). The four petals are removed next. A single one is shown at 11, A being the limb and B the claw. The remaining group of six stamens and the pistil is given at 12, and you will notice that four of the stamens are of equal length and that two are shorter. Remove these and examine each under the glass (13). You have now nothing but the pistil left (14), consisting of the stigma, A, style, B, and ovary, C.

After examining a plant in this way you will know it thoroughly. You will be far less

likely to forget its floral structure than if you had merely moved its organs aside to see if they fitted the descriptions in the Flora (and where you could not see for certain, had-hoped for the best) and passed on to the same half-hearted examination of another plant.

DISCOVERING THE NAMES OF PLANTS.

All good Floras give instructions for the scientific identification of plants, so that the information need not be repeated here. A few hints, however, may not come amiss to the unscientific.

On looking through an illustrated Flora and realizing the number of plants described, amateurs are sometimes confused and disheartened. Cheer up! An hour's study will soon teach you your way about such books.

Let us suppose that you are a beginner. You have found a Yellow Adder's Tongue and do not know what it is. You observe that it has two narrowly oval, pointed leaves, apparently growing directly from the root and peculiarly mottled with brownish purple spots. Between the leaves rises the short, slender,

naked stem which bears at its summit a single rather large, nodding flower. The flower has six divisions all alike, yellow or tinged with purple on the outside and with their tips somewhat bent back. You hardly know whether to call them a corolla or a calyx. When, as in this case, there is only one distinguishable floral envelope, some botanists always call it a calyx, however brilliantly colored it may be; but the most learned are in somewhat the same uncertainty as you and it is more usual to beg the question by calling it a perianth—which is Greek for “around the flower” and is a general term for all floral envelopes, including both calyx and corolla. Within, the flower has a single pistil and six stamens.

A glance at the end of Mathews's *Field Book* shows that it contains about 550 plates, many of which illustrate more than one species—nearly 700 pictures in all. This is nothing to the more than 4,000 species described in technical floras; but it seems a melancholy number of pictures to scan in your search and you naturally hope your plant may come somewhere near the middle of the book.

Another glance shows you that the last sixty-eight pages describe various members of the Composite Family, which have many small flowers grouped together in close heads which often look like a single flower. Your plant cannot belong here; indeed, you would hardly need to be told that it did not go with the Goldenrods and Asters. Next to the Compositae come families equally impossible. The Lobelias have irregular flowers; that is, their petals are of different shapes and sizes in the same flower, instead of all alike, as in your flower. The Bellflowers have a five-parted corolla and moreover the parts are grown together below into a broad tube or urn; in your flower they are separate. Then follow a long series of families—Plantains, Figworts, Mints, Borages, Milkweeds, Gentians—very different from one another but all unlike your plant in that they have five-parted corollas with the divisions more or less united. At page 326, in the *Pyrola* Family, you come for the first time to flowers with separate petals; but the petals are five instead of six. The Parsley Family which comes next has very small flowers usu-

ally in dense, flat-topped clusters; and it and all its neighbors for many pages—Evening Primroses, Violets, Sumachs, Milkworts, Geraniums, Clovers and Roses and their relatives, Mustards, Crowfoots and Pinks—have the parts of the flower in fives or fours or twos, never in threes or sixes.

Next you reach the Amaranths and Knotweeds which have tiny inconspicuous flowers, not at all like yours. The Virginia Snakeroot has irregular flowers again: the Wild Ginger, heart-shaped leaves. Then come the Orchids, in all of which the flowers are of strange and fantastic shapes, very unlike the simplicity and symmetry of the one you have. The Blue-eyed Grass has a six-parted regular flower, but it is nearly flat and, as its name indicates, blue in color; and the leaves are very narrow and grass-like. A glance shows your plant cannot be an Iris—indeed, you know that yourself. The Star-grass has flat flowers and narrow leaves. Here, however, on page 60, you find at last in the Atamasco Lily, a flower which closely resembles yours and feel that you are getting “warm.” But it grows upright, not

nodding and the description tells you its color is "crimson-pink"; also the leaves are grass-like. The Star-of-Bethlehem has several flowers on the same stem and again the leaves are narrow: leaves and color of flowers are wrong in the Day Lily: the Wild Onions have clusters of small flowers which are sometimes replaced by tiny bulbs.

Then you turn the page (54) and there is a plant that agrees in every particular with the one in your hand. Here are same oval, pointed, mottled leaves, the slender, naked stem and the single nodding flower with its six divisions and the six stamens and the single pistil within. Your plant is the Yellow Adder's Tongue or (a very poor name) Dog's-tooth Violet.

You might, of course, have found it more quickly by beginning at the beginning; but I have taken you through nearly all of the *Field Book* backwards so that you might learn as much as possible before you came to the plant you wanted to identify. You have missed only a few of the Lily Family, the Arums and Cat-tails and it will be a small matter to look

over that part of the book and learn something of their characteristics.

Until you are familiar with a few botanical terms you will mainly depend upon pictures for the identification of your plants; so that a freely illustrated Flora will be essential to you. Master the characteristics of the chief Families and you will soon know where to look for most plants when you scan the pages of the book. Later you will rely upon the scientific methods explained in such works.

How to Know the Wild Flowers is a book that beginners will find most helpful (see p. 32). The author has very successfully classified plants first under the colors of their flowers and afterwards under the months in which they appear, a popular method which makes identification delightfully simple and easy. Let us suppose you are trying to identify your Yellow Adder's Tongue by this book. It is yellow, so you look in the section on yellow flowers; and you found it in early spring, so you look near the beginning of that section. The third description exactly fits your plant—"Erythronium Americanum.

Lily Family. *Scape*.—six to nine inches high; one-flowered. *Leaves*.—Two; oblong-lance-shaped; pale green mottled with purple and white. *Flowers*.—Rather large; pale yellow marked with purple; nodding. *Perianth*.—Of six recurved or spreading sepals. *Stamens*.—Six. *Pistil*.—One.”

Not all plants are easy to identify but a few references to the illustrated Glossary (pp. 155 to 168) and a careful examination of each plant will soon make you familiar with the various floral organs. When you have mastered these the Flora will become helpful instead of confusing.

Have you ever thought that methods of growth and arrangement might be better described in English? Try it, and see what long cumbersome descriptions are the result. The same things may be stated very quickly by the use of a few technical terms, and you will soon be familiar with the commonest of these.

EXAMPLE OF PLANT DESCRIPTION

The following description of the Ox-Eye Daisy, Plate VI, taken from Britton and

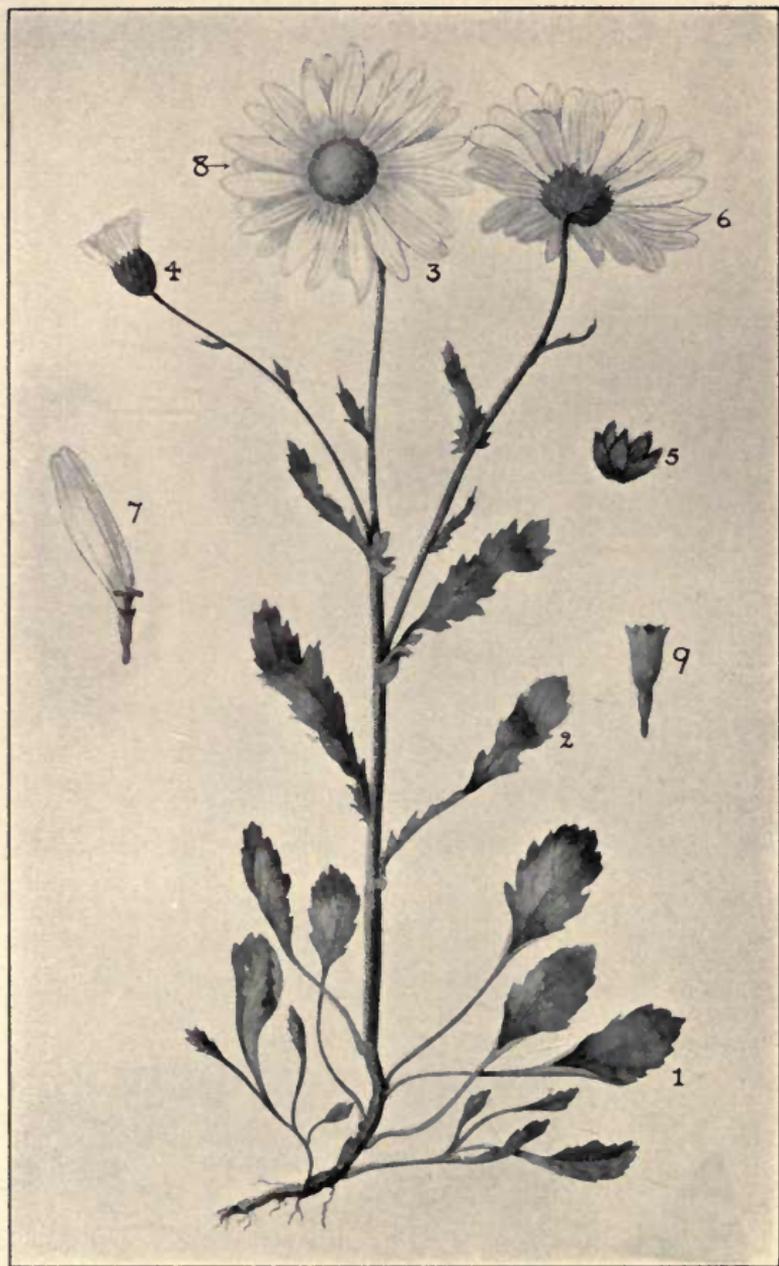


PLATE VI.—OX-EYE DAISY, WITH VARIOUS PARTS ENLARGED.

Brown's *Illustrated Flora*, is not very dreadful, and it should be worked out like an exercise with the plant in your hand. The sentences in brackets are in the nature of a running comment and explanation.

“CHRYSANTHEMUM LEUCANTHEMUM L.
White-weed, White or Ox-eye Daisy. . . .
 Perennial; stem glabrous, or sparingly puberulent (*with a close, short down*), simple or little branched, 1 to 3 ft. high, often tufted, the branches nearly erect. Basal leaves (Fig. 1) obovate (*inversely egg-shaped, the broader end uppermost*), oblong, or spatulate (*spoon-shaped, with a broad, rounded upper end and a long and narrow base*), coarsely dentate (*the margin cut into teeth pointing outward*), or incised (*the margin cut into sharp, deep and irregular divisions*), narrowed into long slender petioles (*leaf-stalks*); stem-leaves (Fig. 2) mostly sessile (*without separate leaf-stalks of their own, sitting directly upon the stem*) and partly clasping (*the base extending around the stem*), 1 to 3 inches long, linear-spatulate (*narrowly spoon-shaped*) or linear, pinnately (*feather-like, the veins branching from the*

midrib on both sides like the webs of a feather) incised or toothed, the uppermost very small and nearly entire; heads few or solitary (*singly, not in clusters*), 1 to 2 inches broad, on long naked peduncles (*flower-stalks*, Fig. 3); rays 20 to 30, white, spreading, slightly 2 to 3-toothed (Figs. 6 and 7); bracts of the involucre (*the rings of leaf-like growth just beneath the florets*, Fig. 4), oblong-lanceolate (*between oblong and lance-shaped, i.e. conspicuously longer than broad and tapering upward or both ways from the middle*), obtuse (*with a blunt end*), mostly glabrous, with scarious (*thin, dry and not green, like the flowers of the "Everlasting" used for wreaths by florists*) margins and a brown line within the margins (Fig. 5); pappus (*the modified calyx of the Composite Family*) none."

THE ART
OF PRESSING
WILD FLOWERS

“The ancient Greeks called the world—Beauty.”

EMERSON.

“A gold and silver cup
Upon a pillar green,
Earth holds her daisy up
To catch the sunshine in;

A little rounded croft
Where wingéd kine may graze;
A golden meadow soft,
Quadrille ground for young fays;
A fenced-in yellow plot
With pales milk-white and clean,
Each tipt with crimson spot
And set in ground of green.”

HENRY S. SUTTON.

CHAPTER VII

THE ART OF PRESSING WILD FLOWERS

Press immediately after identification—Frail nature of most wild flowers—Rules for pressing plants—Unnatural, wizened specimens belonging to some naturalists—Dried plants must not resemble scarecrows—Methods of pressing plants—How to press knobby flower-heads successfully—Changing the drying-papers—Pressing fruits—Use of a storing press.

WILD flowers should be pressed as soon as possible after gathering or identification, for many shed their petals so quickly that if this operation is delayed a day, much time and trouble may be wasted.

A great deal depends upon the condition of the plants when gathered and also upon the weather. A fully blown rose will shed its petals in a few hours, and a younger one that has been dashed by the rain will behave in the same way. Rockroses and Cranes' Bills are notorious offenders, for they drop to pieces very soon after gathering. Plantains and Goldenrod and especially Orchids conduct

themselves in a more seemly manner; but the rule is that plants should remain in water for as short a time as possible. The sooner a plant is pressed the better it will look when mounted, and the longer it is in water the greater the risk of failure.

The following rules should be remembered when pressing flowers:—

1. Plants should be pressed as soon as possible after gathering.

2. The press, drying-paper and folders, scissors, penknife, paint-brush, etc., should be at hand.

3. Press two of each species, taking the frailest flowers first.

4. When pressing plants arrange them according to their natural manner of growth.

5. Arrange plants with the paint-brush, touching them with the fingers as little as possible.

6. Tear a few sheets of blotting-paper into tiny snippets and use these to separate overlapping petals, and to equalize pressure round thickened stems or flower-heads: or small

pieces of newspaper, folded to the desired thickness, may be used.

7. Do not stint the drying-papers and change these frequently.

8. Use at least two driers between each plant and its neighbor. Knobby plants will require more.

9. Do not allow the papers to slip when strapping up the press.

10. Do not put the press under too great a weight at first. Increase the pressure after changing the drying-papers.

11. Damp papers should be dried and stored in a drawer for future use.

12. Plants must never be removed from the press before they are *absolutely dry*. When dry they are better mounted as soon as possible, as they grow more and more brittle with age.

13. Botanists with no leisure for mounting in addition to pressing should remove all dry plants to a storing-press, where they may remain in safety until the winter.

You will find more or less meager directions for pressing plants in several good Floras and

botanical text-books; but if naturalists would take the operation more seriously, we should see far lovelier botanical specimens than is usually the case. Hurriedly pressed plants very rarely turn out well.

A few years ago an enthusiastic botanist asked me to look over his collection of rare species. A mighty portfolio was dragged from its place, large mounts were tenderly handled, and the learned one proceeded to declaim upon the rarity of the specimens, their wonderful construction and their exceeding beauty.

Poor, wretched, wizened things! They might have been rare, no doubt they were wonderful, but their beauty had so completely departed that my imagination was unequal to the task of calling up the vision of what "might have been"; besides which, I was cudgeling my brains for suitable yet truthful answers to the poor man's raptures. I was gazing at a scare-crow, ugly enough to strike terror into the breast of the most impudent of little sparrows, while a story of the plant's extraordinary beauty was being poured into my ears. The situation had its difficulties!

Then we passed on to the next specimen. Was it a miniature sign-post? Before me lay a bare, thick stalk destitute of leaves or branches until two inches from the top, where two maimed arms pointed despairingly to right and left. In the lower left-hand corner lay a strange-looking object that I made out to be a leaf—pressed separately to show the poor thing bore leaves after all. I looked at the tips of the horizontal branches almost expecting to read there, “One step to somewhere else. Ten miles to anywhere,” for the whole plant looked so cynical.

“Rare, rare, extremely rare!” the old man murmured ecstatically, while a boy friend muttered, “*What* a freak!” in that sepulchral undertone so beloved of schoolboys.

Pressed wild flowers can easily be made to look like flowers and really ought to be distinguishable from scare-crows and sign-posts; yet they too often resemble these useful objects, for their petals and leaves are mangled out of all recognition and their branches spread out at impossible angles. They remind one of the strange drawings of little children, with the all

too necessary titles: "This is a man," "This is a cow."

Rare plants, however crumpled and faded, have a certain interest for enthusiasts, but the ordinary flower-lover does not appreciate them; so that if you want an attractive collection you must learn how to avoid brown Anemones and green Buttercups and all other freaks of this kind.

When you have identified your plants and decorated unfamiliar ones with name-tickets, see that your press and all other necessities are at hand.

Unstrap and open the press; place two sheets of drying-paper on the lower board. Take a folder from the pile and write on it the name and the date and place of collection of the plant you are about to put in it, or, if you are using numbers, the number under which its record appears in your note-book. If your folders are made of old newspapers and there is no margin on which to write, this information may be put on a separate slip of paper but you must be careful not to lose or misplace it. This done, place the open folder on the drying-

sheets in your press, with the folded edge at your left.

Take a plant from the jar; dry off any moisture with a clean rag, and place the plant upon the lower page of the folder. If it fits this it should also look well upon the mount. When the press measures more than the mounts, keep a mount at hand and place the plant upon this, so that you may judge of the effect. It is useless to press 20-in. plants for 16-in. mounts, and the former are far less likely to be damaged if cut to the right size *before* pressing than after they are dry and brittle. I strongly advise you to have the drying and mounting sheets of equal sizes, for it saves endless time and trouble.

If a plant is to look well on the mount it must not cover too large a portion of the folder. Do not let the flower come close to the upper edge or the stalk to the lower one.

When plants are thick and bushy some of their under leaves or branches may be cut away, that is, those springing from the side of the stem nearest to the folder. This must never be done where it is avoidable, and must

never be overdone or the plant will look unnatural; but almost anything is preferable to a confused mass of leaves so closely overlapping that all ideas of form and arrangement are lost. Note which leaves or branches may be best dispensed with and snip them off with the scissors.

Plants must be pressed in natural positions, so that when gathering them you should notice how they grow. Trailing plants must trail in the press or they will never do so on the mounts. Drooping flowers must droop and not be tortured into a vertical position; while those whose growth is severely upright should be pressed and mounted in this way and not in a slanting line across the paper. Plants are sometimes found growing in an unusual way, but the characteristic growth is the one that should be chosen for the herbarium.

Look at the wizened little piece of Wild Yamroot shown at the left of Plate VII, and imagine what effect a number of such objects would have upon your spirits! Yet this is the way many people press and mount their specimens. The plant looks like some poor victim



PLATE VII.—WILD YAM-ROOT.
Rightly and wrongly preserved.
(From a photograph.)

strapped down for dissection; while the other, though flat-looking and not to be compared with the living, waving trails of the thicket, still gives, by its graceful lines, the idea of a wild rambling plant. Dried plants can never look like pictures of living ones, and it would be absurd to expect this, for after pressure the rounded stems and folding, curving leaves become flat and severe, and until a preservative is discovered, some of the more delicate colors are bound to fade. But with careful arrangement and pressing many very lovely specimens may be obtained, and comparatively few plants will change color.

When the plant is laid out on the drying-paper some of its leaves and flowers will lie sideways and others "face" downwards. Press them in these positions and you will have a far more natural plant than if every part had been arranged "full-face." Many botanists press the roots also, and in small plants like the Anemones and Purple Gerardia this is easily done; but the roots of tall growing species need to be cut off and mounted separately at the lower side of the main portion (see

Plate VIII, Purple Iris). Instead of cutting the stem, professional botanists bend it sharply into the shape of an inverted V or even an N if it is very long, thus making the doubled-up plant short enough to go on the mounting-sheet. This method has the advantage of honesty and scientific accuracy; it proves that no part of the plant has been removed or otherwise tampered with; but, of course, it does make some portion of your plant lie upside down and your specimens look rather as if a mischievous small boy had knocked them over with a stick.

If the plant will not lie of itself as you want it, hold the upper page of the folder in the left hand, arrange the stem and open the leaves and petals with the paint-brush while gradually covering the plant with the paper as it is prepared with the brush.

The best method with some plants may be to cover each leaf and flower with separate snippets of blotting-paper; to hold a group of such snippets in place by a larger piece; and to secure the two or three larger pieces by the final closing of the folder. This sounds fussy, but



PLATE VIII.—PURPLE IRIS.

How to arrange tall growing plants for preservation.

the results fully justify all the care and trouble involved. Several snippets are sometimes used for one flower. They act as pads round knobby stigmas and prevent the upper petals being torn by lying directly over these. As the stigma is pressed flatter and flatter, these snippets will be removed one by one when the drying-sheets are changed.

In the case of a Buttercup, for instance, you will slip a tiny piece of blotting-paper between the upper petals and those lying immediately upon the folder. A second snippet will cover the upper petals. Each flower will be separately treated, but fully opened ones will require only one piece, and as these are laid down the upper petals should be stroked open with the brush. Begin at the left; when the flowers and leaves nearest this side have been treated, it is wise to cover them with a part of the upper page of the folder before treating the rest. It may be held in place with the left wrist and fore-arm while the fingers of the left hand hold its upper edge and guide it further and further over the plant as the right hand prepares the flowers and leaves. If the leaf segments are

beginning to curl, tiny strips of blotting-paper will be useful for treating the parts separately; but if the plant is fairly fresh the paint-brush is generally enough, and each segment can be stroked open as the upper sheet descends upon it.

You will want two pairs of hands at first, but a little practice will soon give the knack of the method. A book may sometimes take the place of your left wrist, and long adhesive strips can be used to hold the snippets down.

When the plant is covered by the upper page of the folder, place two driers on it. More should be used over and under thick and wiry or very fleshy plants.

Another folder is now laid on these driers and the next plant arranged in it. Build up your pile carefully and see that no slipping occurs.

When all the flowers have been pressed in the same manner, place the upper press board upon the top of the pile. Arrange the straps on the floor; lift the pile onto these and secure the press. This needs to be done very care-

fully, for jerky, rough pulling or unequal strapping may undo much of the previous work. Never pull either strap to its tightest while the other is unbuckled. Secure one first, then the other, leaving both rather slack and taking care that the papers do not slip. Next tighten the first strap and after this the second, and put the press in a safe place. The pressure should not be too great at first, for while plants are soft and full of sap they are very easily bruised. It is hard to say just how much should be applied, for it varies according to the kind and number of plants you are pressing. Stiff and tough plants need more than delicate ones and a big pile more than a little one. Forty pounds is usually none too much; and more will be required for a very full press. The foot is a handy instrument for applying pressure and the straps, if pulled tight, will generally hold it well enough until the time for changing driers. But plants shrink somewhat in drying and the straps will, of course, not follow up this shrinkage. If you wish to be doubly sure of even

pressure, you can place weights on your press. Old pails or oil-cans with handles, filled with sand, make convenient weights.

There are a few plants that must be pressed in the fields, for it is generally impossible to do so by the time home is reached. Rockroses and Cranes' Bills shed their petals very quickly and all species of the *Convolvulus* close up soon after they are gathered; and what is more, they absolutely refuse to open when placed in water, but sulk until they die! Choose a warm, still day for securing such specimens, and take your press, note-book, paint-brush and magnifying-glass with you into the fields. The little Hog Peanut may, in spite of its name, be made to look most attractive when pressed with the grass stem round which it may be twining.

When pressing Ox-eye Daisies and other knobby flower-heads, cut a circle of blotting-paper two to three inches in diameter, with a circular hole in the middle, so that when laid over the flower-head the golden disc peeps through. A similar circle is cut in cotton-wool or wadding and laid over this (see Plate IX).

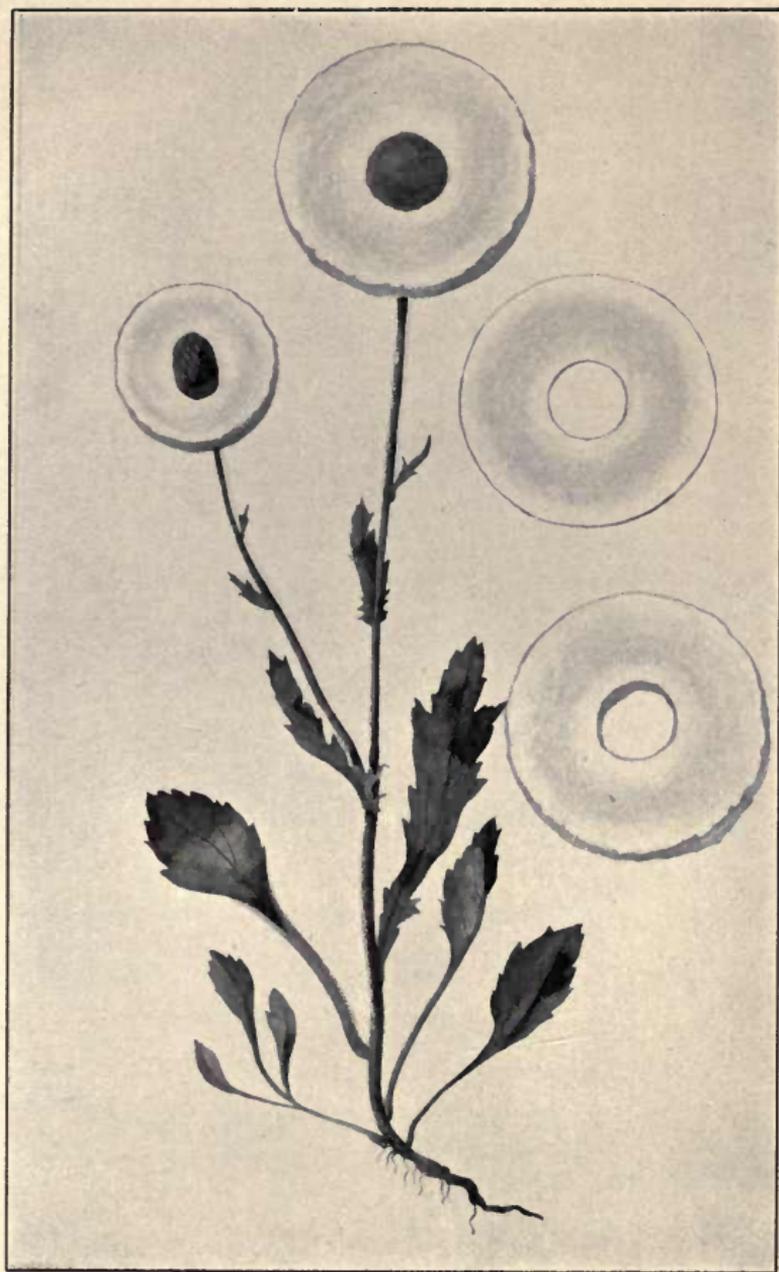


PLATE IX.—HOW TO PRESERVE AN OX-EYE DAISY SUCCESSFULLY
WITH BLOTTING-PAPER AND WADDING CIRCLES.

When the drying-sheets are placed over the plant, the white ray-florets will then receive equal pressure with the disc. If such flowers are pressed in the ordinary way, the disc breaks, and the florets of the ray, through receiving little or no pressure, become shriveled and brown.

Some botanists advise twenty-four hours pressure before the first change of the drying-sheets, while others give twelve as the correct interval. The truth is that "circumstances alter cases." Most yellow flowers and dry plants such as Buttercups and the wiry little Sandworts may be left quite safely for twenty-four hours. Other plants should receive attention after four to twelve hours if you wish to preserve as much of their color and beauty as possible. When once the drying-papers have become damp, no good can result from leaving the plants between them. Damp papers turn Roses and Cranes' Bills and white flowers brown, and mildew very quickly makes its appearance. The two secrets of successful pressing are: (1) natural arrangement, and (2) frequent changes of the drying-papers.

Changing the drying-papers is an operation that requires some care, but it is by no means so long or so harassing as the one just described.

Place the press upon a table and see that the paint-brush and plenty of fresh drying-papers are at hand.

First carefully unstrap the press and, removing the top board, place it near by with two fresh driers upon it ready for building up a new pile of plants.

The damp drying-sheets are now removed from the pile and put aside to be dried for future use. This exposes the folder, which must be opened with great care. The right-hand edge should be lifted up very slowly with the fingers of the left hand, and if any part of the plant beneath adheres to this upper page it should be released by soft touches with the paint-brush or, if this is not sufficient, with the blade of a penknife.

When this upper page has been peeled off, remove any snippets one by one, and if either petals or leaves are creased, smooth these out with the brush. Leaves that are

badly crumpled may be smoothed and pressed out by a moistened finger. Pass the tip of the fore-finger over a wet cloth and stroke and press the leaf into shape again. Dipping the finger into water would bring too much moisture on to the plant and, needless to say, the finger should never be moistened by the tongue.

Now that the plant is flatter it will require fewer snippets to keep it in place and, as a rule, only one should be allowed for each flower. Those which have held awkward leaves in place can usually be removed, since the leaves will have lost most of their stiffness. Knobby parts must, of course, be surrounded with several snippets, or folded pieces, as before. Plants that have become badly creased should be thrown away, for it is never worth while to mount such specimens unless they are rare.

When all has been arranged and damp snippets exchanged for dry ones, close the folder, lift it with the plant inside on to the fresh driers made ready for it, cover it with other driers and proceed to treat the remaining plants in the same manner. The pressure may be increased by tightening the straps and add-

ing to the weights. In later changes of driers it will often not be necessary to open the folders at all.

All damp papers should be dried at once, either in the sun or by a fire; and when dry they should be shaken free from any dust and put away in a drawer for future use.

Some plants require many changes before they are fit to leave the press, while others are ready for mounting after the third or fourth change. They may be tested by lightly touching with the back of the hand. I once mounted a Parsnip when its umbel was slightly damp. The stem and leaves were perfectly dry, and I thought the clustered flowers might be left to finish off in the herbarium. A fortnight later I had occasion to look at this plant. The Parsnip flowers had changed their yellow for a bright grass-green, and over the whole cluster a fine crop of mildew had grown up!

Many botanists now use, in place of one of the driers over each specimen, a sheet of corrugated board. The effect of this is to ventilate the pile of plants and if the press can be put in a dry place in the sun or in a current of

warm air, it hastens the drying very much. One change of driers is usually all that is required and that more for arranging misplaced parts of the plants than anything else. This method, however, loses much of its effectiveness in wet weather or in a damp place, unless artificial heat can be had.

Directly the plants are dry they should be removed from the press and not be allowed to remain where moisture from fresh, damp plants will soak into them. Place them in a drawer or box in their folders and mount as soon as possible. (They should not lie loose and unmounted for more than four days.) Only one plant must lie in each folder so that no two touch, for dried plants are exceedingly brittle and easily chipped.

So far the directions have dealt only with the pressing of the plant in flower; but as each species is incomplete without its fruit, these must be gathered and pressed in their seasons. Some plants "go to seed" very quickly, and many show buds, flowers and fruit upon the same spray. Others do not mature for several months, and some become various colors in

turn as they ripen. Blackberries, for instance, are green in the first stage, crimson in the second, and black in the third; and the Withe-rod has berries that are first green, then pink, and finally blue. The fruit of the Jack-in-the-Pulpit changes from green to the glowing scarlet that lights up the dim recesses of our wooded swamps in late summer and autumn; while the feathery awns of the Wild Clematis turn gradually from silky bunches of silvery green to the hoary gray masses that have been so quaintly christened "Old Man's Beard."

All these fruiting stages should be represented in the herbarium, for by preserving the life story of every plant you will add to the beauty and interest of your collection.

Now for a few practical words about the pressing or drying of these fruits, for, as you may imagine, it is not always an easy matter! Berries have an unpleasant habit of bursting, or breaking away from their attachment, and some are so hard and thick that pressure seems out of the question. Seed-vessels, too, are often as hard and awkward as the fruit inside. No one rule can be laid down for the treatment

of all. Methods must be adapted to individual requirements. Soft fruits such as Blackberries, Jack-in-the-Pulpit and Strawberries should be dried in the press, but the surface surrounding them must be leveled up with blotting-paper and wadding. The pressure should be very slight and the drying-papers frequently changed. If these rules are neglected, the result will be little patches of red and black pulp—and such things hardly add interest or beauty to one's collection!

The thick clusters of the "Jack's" fruit may be considerably thinned out by removing the under berries that would lie immediately upon the mount. Do not detach too many or the natural effect will be lost.

Hard fruits, such as the scarlet and crimson Hips and Haws, should be fastened on to cards with a needle and thread and placed in a cool, dry place for several days. The thread will prevent the stem twisting awkwardly as it dries. When stalk and fruit are hard and stiff they should be cut from their moorings and fastened to a mount with a few touches of glue. While this fixative is drying, the plant should

be leveled round with blotting and newspaper folds, and a very light weight may be placed on the top of the pile. There must be sufficient pressure to hold the branch in place, but not enough to flatten or bruise the surface of the fruit.

Some seeds and seed-vessels are soft and pliable in their early stages and easily dried in the press, while maturer fruit from the same plant may become hard and brittle, or woody, in which case you will have to use your own discretion about drying them in the press or on a card as the Rose Hips are done.

The pods of Wild Lupine are soft and green at first, and the little peas inside make only the tiniest of bulges in the flat surface of their cradles; but as the summer days go by both peas and pods enlarge and harden and the tender green is changed for black. Later still the pods split up the back and front and each piece curls and twists as the peas are shot out one by one. At their largest these pods are not very bulky, and as the leaves are still plentiful on the stems that bear the fruit it seems a pity not to dry the branch in the press.

The level should be made up by blotting-paper folds or wadding, so that the leaves receive sufficient pressure to keep them in shape; but the pressure must not be heavy or the pods will crack.

Botanists who have no leisure to mount their plants during the spring and summer should transfer them from the ordinary press to a storing-press where they may be safely kept until the winter-time. However carefully dried plants are laid in drawers or boxes, their leaves are bound to curl if left free to do so for more than three or four days. This storing-press should consist of two stout pieces of card or corrugated board and a folded newspaper for top and bottom. Put your specimens in their folders between the boards and secure with tape or coarse twine tightly tied. Do not apply too much pressure; a very little is enough to keep leaves from curling and too much will break the brittle plants. Do not put in driers; they will absorb moisture in damp weather and mildew and discoloration may result.

If you use labels, they may be written and placed with the plants.



MOUNTING
THE
PLANTS

“Memories dear are with us ever,
Like the scent of roses all the year.”

“God has given us our memories that we might have
roses in December.”

CHAPTER VIII

MOUNTING THE PLANTS

Plants must not be left long unattached—Requisites at hand for mounting—How to mount the plants—Pressure—Portions not adhering to be refixed—Classification in the herbarium—Natural growth to be studied—How to mount plants in albums—A collection of graceful, natural-looking plants—“Let Nature be your teacher.”

MOUNTING wild flowers is an ideal occupation for winter evenings; but it must not be postponed until then unless a storing-press is used. Dry plants persist in curling up a little if left unattached and without pressure for more than a few days.

When a number of specimens are ready for mounting, place the box or storing-press containing them upon a large table, covering the rest of its surface with a newspaper, and arranging the following articles in handy positions:—Glass plate, mounts or album, large brush, pot of glue and one of water, or better,

vinegar, scissors, forceps, drying-papers or newspaper pads, a few sheets of card or corrugated board (and your press if it is not in use) and a weight of about ten pounds.

Put the glass plate and pile of mounts side by side on the table. Take a plant from the box and, placing it upon a mount, arrange it to the best advantage, remembering its natural mode of growth. (Plates X and XI show the results of right and wrong methods in pressing and mounting.) Then mark with a pencil a few guiding dots to show the position of the extreme points of leaves and stem, taking care to leave room for the label at the lower right-hand corner.

Now, with your large brush, paint the glass over with a thin coat of glue. Liquid glue as you buy it is usually a little too thick; small parts of the plants are liable to stick in it and break off. You can thin it to the required consistency on the plate by dipping your brush first in glue and then in vinegar. In this way you can also vary the consistency for different plants. Stout, stiff ones need thicker glue to hold them than thin and delicate ones.

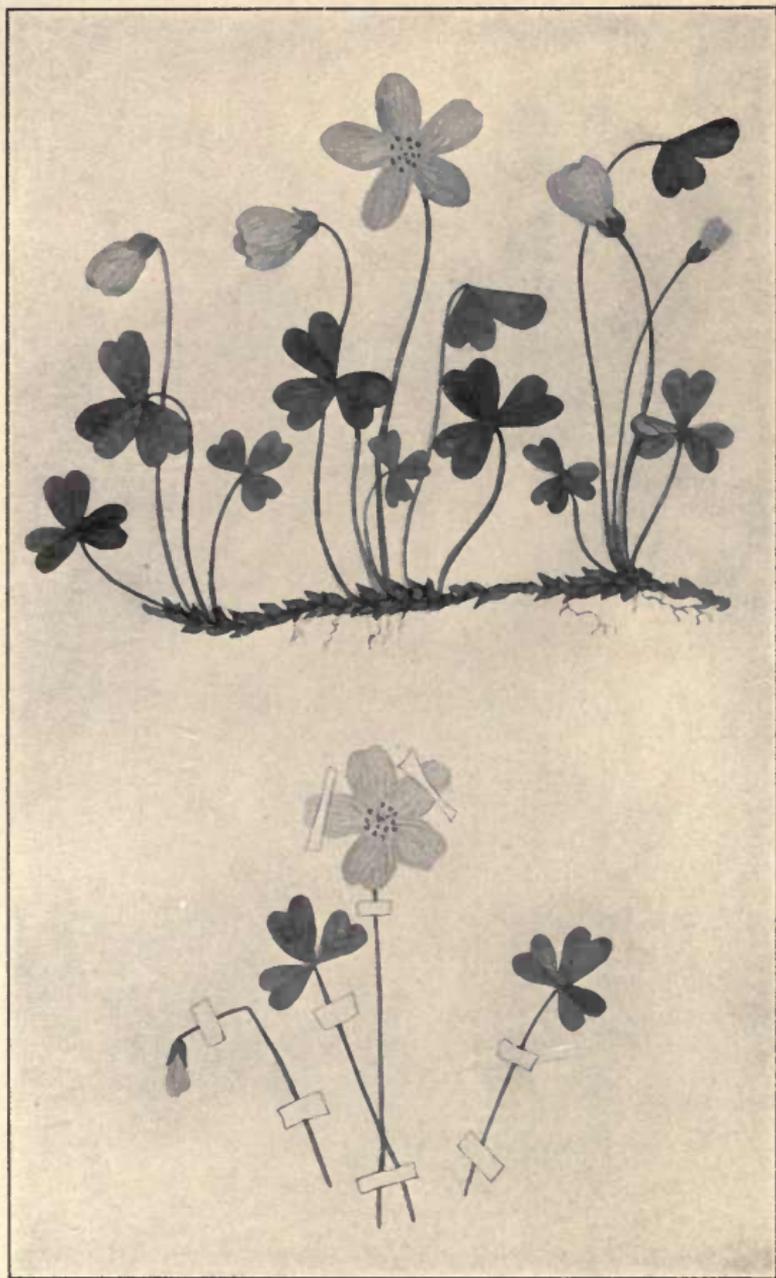


PLATE X.—WOOD SORREL.

The correct method and the "Walking Stick" method of mounting.

When the plate is covered with glue, lay the plant on it, being careful to put it "back" down—that is, the side which is to go next the mount. See that every part touches the glue; push down gently those that do not at first. Then with the forceps or your fingers, take the plant by the lower part of the stem, lift it carefully from the glass (a too sudden motion may break off small parts) and lay it on the mount, taking care to observe the guiding dots. If you are using felt-paper driers, lay the empty folder over the plant on its mount. Then put the whole on one of the sheets of cardboard or the bottom of your press, cover it with a drier or newspaper pad, smoothing and pressing this down with the hands, and over all arrange another sheet of card-board or the top of your press and the weight.

Brush over the glass with fresh glue and proceed as before.

Some delicate plants dry very limp and are hard to transfer from the gluing plate to the mount. For such cases, it is well to have at hand an old mount or a piece of newspaper cut to size, on which the plant should be laid care-

fully *glued side up*. It can then be arranged as you wish it without sticking in inconvenient places. When this is done, lay the mount on it, press down lightly with the hand, turn over the "plant sandwich" thus formed, peel off the old mount and you have your specimen mounted as it should be.

Each plant as it is added to the pile should be covered by a drier or folds of newspaper and, if it is at all knobby or twiggy, by card sheets, lest these thick parts should leave an impression upon the mounts above and below them. *Clean paper must cover each plant*, since if this sticks at all it is easily removed with a penknife, whereas the gray drying-paper might leave an unsightly mark.

The plants should now be left under pressure for several hours, after which they must be carefully examined. Any leaf or petal not adhering must be cautiously lifted and retouched with glue by sliding a small brush under it and the plant pressed as before. If this is neglected, such parts will chip off and the whole plant will be spoilt. When thick stems refuse to adhere they should be treated with thicker

glue. If the twigs are too bent to lie flat upon the mount they may be held in place by narrow strips of gummed paper or plaster, and ends of stems which are likely to spring up when the mounts are handled should also be so secured. Use only enough strips to hold the specimen firmly in place; too many make the plant look like some bandaged victim.

This is a good time to write the labels, if you have not done so already, and to attach them; and for this purpose your Flora and note-book should be at hand. If you write directly on the mount, this is the most convenient time to do it; but if you use detached labels they may be written before mounting and attached when you glue the plants.

When every part of a plant is adhering to the mount it should be put away in the herbarium case or boxes and the plants should be classified as far as possible from the beginning. As time goes on and more and more specimens are added to the collection, they should be arranged not only according to their Families, but also according to their Genera. Meadow-sweet, Blackberry, Avens, Wild Strawberry,

Cinquefoil, Agrimony and Wild Rose all belong to the Family Rosaceae, but each represents a separate Genus in that Family. All of one Genus should be together and the Genera should follow one another in the same order as that given in the Flora.

Specimens belonging to the same Family and, as the collection grows, those belonging to the same Genus, should be put in a genus-cover (a folder of stout manila or tag paper, slightly larger than the mounting-sheets when folded) and the name of the Family or Genus written in the lower left-hand corner. These covers are of great service in protecting specimens in handling, especially when a few are drawn out from the middle of a pile.

Reference was made just now to the necessity of mounting plants according to their manner of growth. They may have been pressed naturally, but unless they are arranged upon the mount in a natural position half the beauty of your collection will be lost. I have seen such erect plants as Agrimony, Yarrow and the Willow Herbs placed in a slanting line across the mount, either for the sake of in-



PLATE XI.—PALE SPIKED LOBELIA.

The "sign-post method" of mounting and the correct one.

(From a photograph.)

cluding an extra inch of stalk or from a false idea of its being a more artistic method. The type of mind that delights in such arrangements can never endure the obvious and the simple. It delights in having photo-frames and books placed criss-cross upon a table, while cushions cannot be allowed to repose naturally upon their sides, but must, instead, balance skittishly upon one of their corners. Now, if you prefer cushions standing upon tip-toe, by all means place them in that way; but you must not arrange your dried plants after the same rule! Erect plants must be mounted in an erect position, and those that bend and curve when growing must do so upon the mount. Long, creeping plants should be arranged with their stems parallel with the longer side of the mount, the latter being turned round so that what was the left-hand side becomes the bottom. In such cases the label should come at the top right corner. If this rule is kept, the labels will lie immediately under one another in the herbarium and so make references to it both quick and easy.

Some plants, such as Little Sun-drops and

Shepherd's Purse, frequently bear flowers and fruit upon the same spray, and whenever possible such specimens should be chosen in preference to others. The fruits of other plants must be gathered in their seasons and mounted on separate sheets. Other plants are small, like the Strawberry, and specimens in flower and fruit may be mounted side by side as photographed in Plate XII.

Botanists who wish to mount their plants in albums should fasten the specimens to the card leaves with narrow strips of gummed paper or surgeon's plaster. These strips must be sparingly used and placed only where they are of real use. The plants may then be removed at any time to separate mounts or to larger albums by carefully cutting away the strips. If there is no wish to remove them, they may be secured by glue in the ordinary way; but only one side of each page must be used, or the plants will touch and injure each other. Plants secured by glue are far less likely to be chipped than those that are merely held in place by adhesive strips.

After filling a page with specimens, the



PLATE XII.—THE WILD STRAWBERRY IN FLOWER AND FRUIT.
(Photographed from the herbarium of May Coley.)

album must be put under pressure until the glue is dry and every plant is adhering perfectly. Inequalities of thickness caused by stout stems or flower-heads are more awkward to deal with in albums than when separate mounts are used; and as plants will not adhere without equal pressure upon every part, the level must be made up by placing folds of blotting-paper over the thinner portions. When the plants are perfectly dry and secure—and not before then—the next page may be filled.

An album of dried plants may be a very dainty and interesting possession, or merely a hopeless collection of dreary-looking objects resembling a scattered and flattened out rubbish heap more than anything else! Everything depends upon natural and careful pressing and mounting. Do not overcrowd the book, for the result will be confusion. Leave restful spaces between the groups, and let trailing plants trail as they will across the pages, even if they seem to take up an extravagant amount of room.

Nature cannot bear to be stifled and

cramped. She is ever fighting against it. See how the plants push up to the light and the air. Notice how eagerly they clamber through and over the bushy thickets, already so full of competing life, and once free of the thick shrubbery, how luxuriantly they wave in the freedom of the upper air, bending and swaying with every passing breeze and almost laughing in the sunshine!

“For 'tis my faith that every flower
Enjoys the air it breathes.”

A GLOSSARY
OF BOTANICAL
TERMS

“And the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good.

“And the evening and the morning were the third day.”

GENESIS i. 12, 13.

“Where does the wisdom and the power divine
In a more bright and sweet reflection shine?
Where do we finer strokes and colors see
Of the Creator’s real poetry,
Than when we with attention look
Upon the third day’s volume of the book?

.
But we despise these His inferior ways
(Though no less full of miracle and praise):
Upon the flowers of heaven we gaze;
The stars of earth no wonder in us raise,

.
Although no parts of mighty nature be
More stored with beauty, power, and mystery.”

ABRAHAM COWLEY, *Gardens.*

CHAPTER IX

A GLOSSARY OF BOTANICAL TERMS

Various roots.—Stems—Leaves—Leaf arrangements—
The inflorescence—The flower and its parts—Various
forms of the corolla—Fertilization—Fruits—The
seed—The embryo.

NOTE.—*The definitions in this Glossary are based, mostly, upon those found in Bentham and Hooker's "British Flora"; but they have been greatly simplified and only the terms most commonly used have been included.*

ROOTS.

A Root is that part of a plant which descends into the earth and draws up nourishment from it. It also fixes the plant securely in the ground.

A Fibrous Root is one that is made up of fibers. (1)

Tuberous Roots are mainly composed of short, thickened portions called tubers. (2)

Tap Roots are of tapering, conical shape, and they give off small fibers. (3)

STEMS.

The stem is the ascending axis of a plant, bearing the branches, leaves, flowers, and fruit. It is through the stem that the nourishment taken up by the root is distributed as sap, first to the leaves, and afterwards to the various other growing organs of the plant.

Nodes are the points on stems at which leaves or branches are given off.

Internodes are the spaces between the nodes.
(4)

Stems are said to be—

Erect, when they grow in an upright position. (5)

Decumbent, when the lower portion trails on the ground, and the upper curves to an erect position. (6)

(*Procumbent*, when the greater part trails on the ground.)

Creeping, when they trail on the ground and give off roots at the nodes. (7)

Climbing, when they support their increasing length by catching on to other objects by means of hooks or prickles, (A); by tendrils

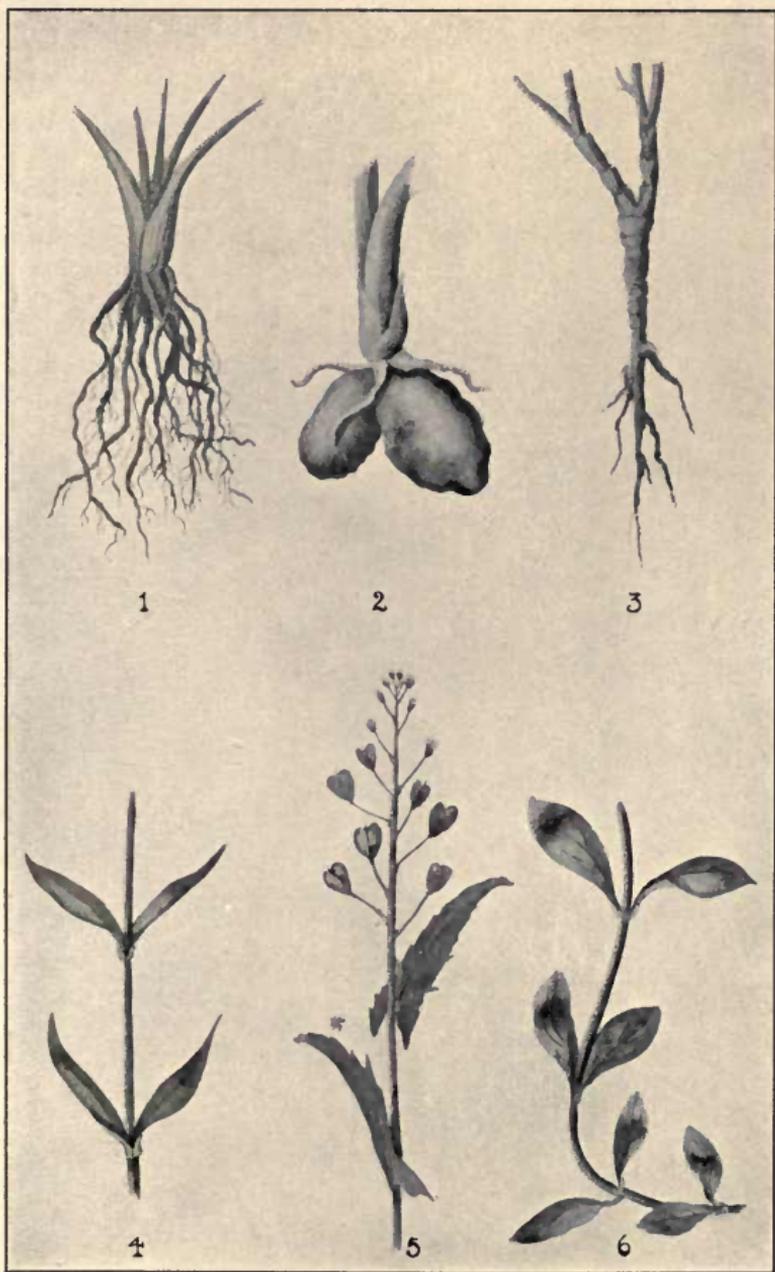


PLATE XIII.—FIGS. 1-6.



PLATE XIV.—FIGS. 7-9.

(B); by twisting leaf-stems, (C); or by aerial rootlets, (D). (8)

Twining, when they twist themselves round a support, sometimes the stem of a stronger plant. (9)

LEAVES.

Leaves digest the nourishment carried to them by the stems, absorb carbonic acid gas, breathe out oxygen, and give back the assimilated sap to the stems.

The Blade is the main part of a leaf.

The Base is the end by which it is attached to the stem.

The Apex is the opposite end.

The Margin is the edge.

The Mid-rib is the principal vein which runs from stem to apex.

The Petiole is the leaf-stalk by which a leaf is attached to the stem. (10)

LEAF ATTACHMENT

Leaves are said to be—

Sessile, when the blade sits directly on the stem and has no leaf-stem (petiole) of its own. (11)

Amplexicaul, when the base of the blade clasps the stem. (12)

Perfoliate, when the base of the blade closes round the stem. (13)

Decurrent, when the margins of the blade continue along the stem. (14)

Sheathing, when the base of the blade or the expanded leaf-stalk forms a sheath or covering round the stem from the node upwards. (15)

LEAF POSITION.

Leaves are said to be—

Radical, when they spring directly from the root.

Cauline, when they spring from the stems.

Both may occur upon the same plant. In some cases the radical and cauline leaves are very similar to each other, while in others they are entirely different, as in the Cuckoo Flower. (16)

LEAF ARRANGEMENT

Leaves are said to be—

Opposite, when two spring from the same node on opposite sides of the stem. (17)

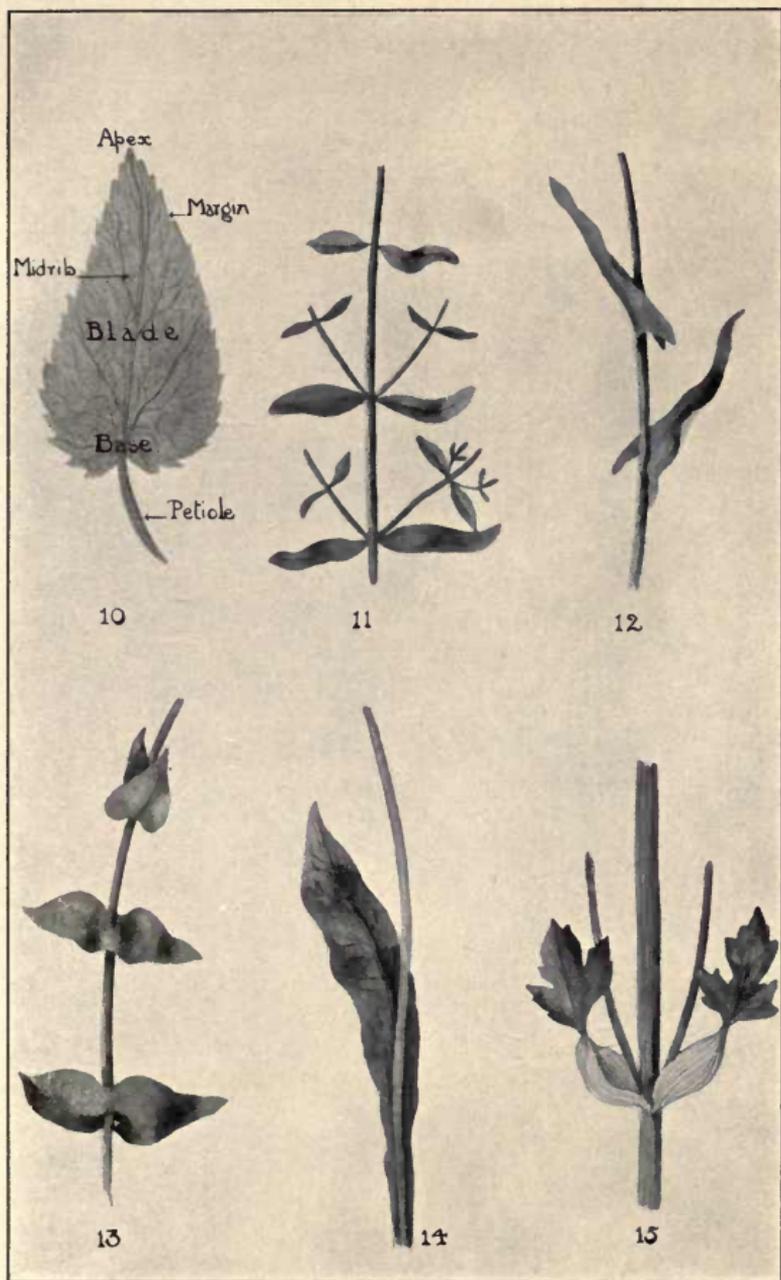


PLATE XV.—FIGS. 10-15.

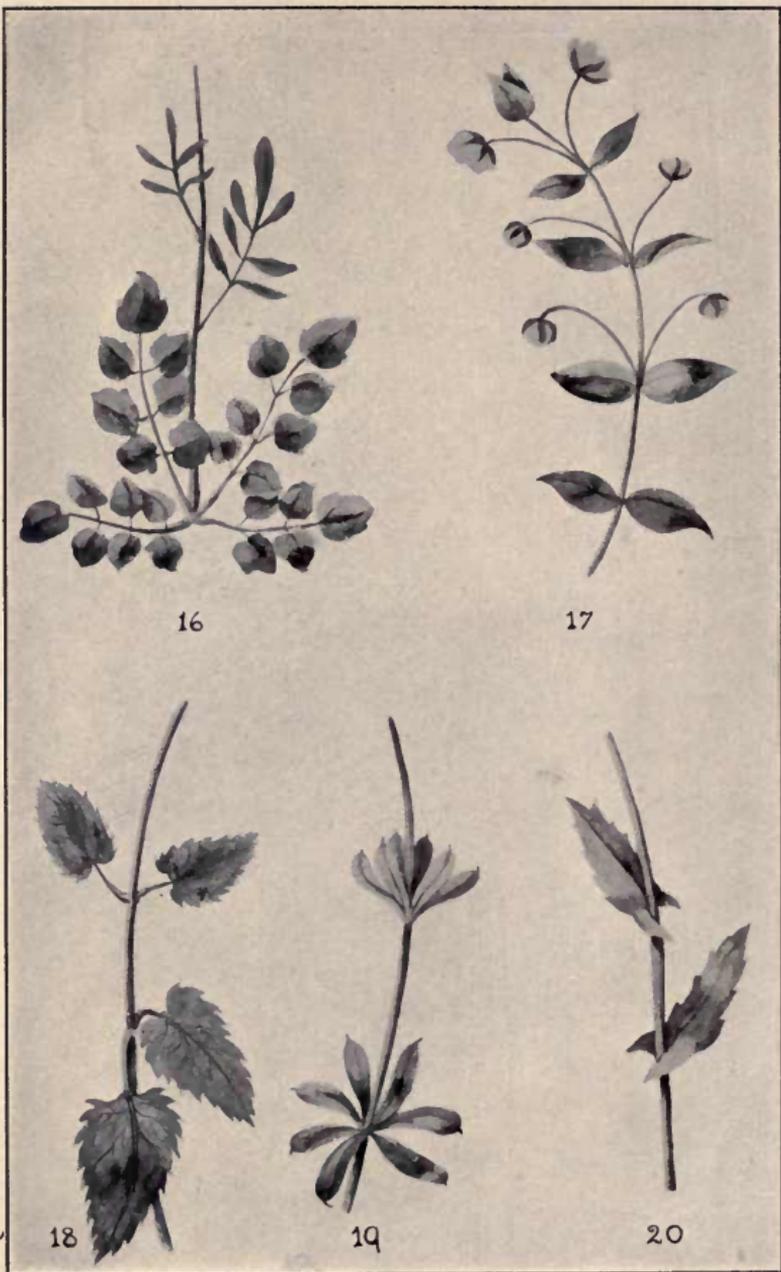


PLATE XVI.—FIGS. 16-20.

Decussate, when each opposite pair is at right angles to the pairs next above and below it. (18)

Whorled, when several spring from each node, radiating from the stem as spokes do from the hub of a wheel. (19)

Alternate, when only one springs from each node, and always from a different side of the stem to those immediately above and below it. (20)

LEAF FORMS.

Simple Leaves.

Simple Leaves consist of one piece only, whether undivided or cut up into lobes or segments.

Lobed, when cut more or less deeply into lobes. (21)

Pinnatifid, when the lobes are divided nearly to the mid-rib, in a feather-like manner. (22)

Divided, when the lobes divide to the mid-rib, but cannot be separated from the leaf-stalk without tearing the blade. (23)

Compound Leaves.

Compound Leaves are divided down to the mid-rib into separate *Leaflets*, each of which may be separated from the leaf-stalk without tearing the blades.

Trifoliate, consisting of three leaflets springing from a common center. (24)

Palmate, consisting of several leaflets springing from a common center. (25)

Pinnate, divided into several leaflets springing from either side of the leaf-stalk in a feather-like manner. (26)

Interruptedly Pinnate, having a smaller pair of leaflets between each larger pair. (27)

Abruptly Pinnate, finishing abruptly with a pair of leaflets; having no single, terminal leaflet. (28)

LEAF OR LEAFLET MARGINS.

Leaf or leaflet margins may be—

Entire, not indented in any way. (29)

Serrate, cut into saw-like teeth. (30)

Crenate, cut into rounded teeth. (31)

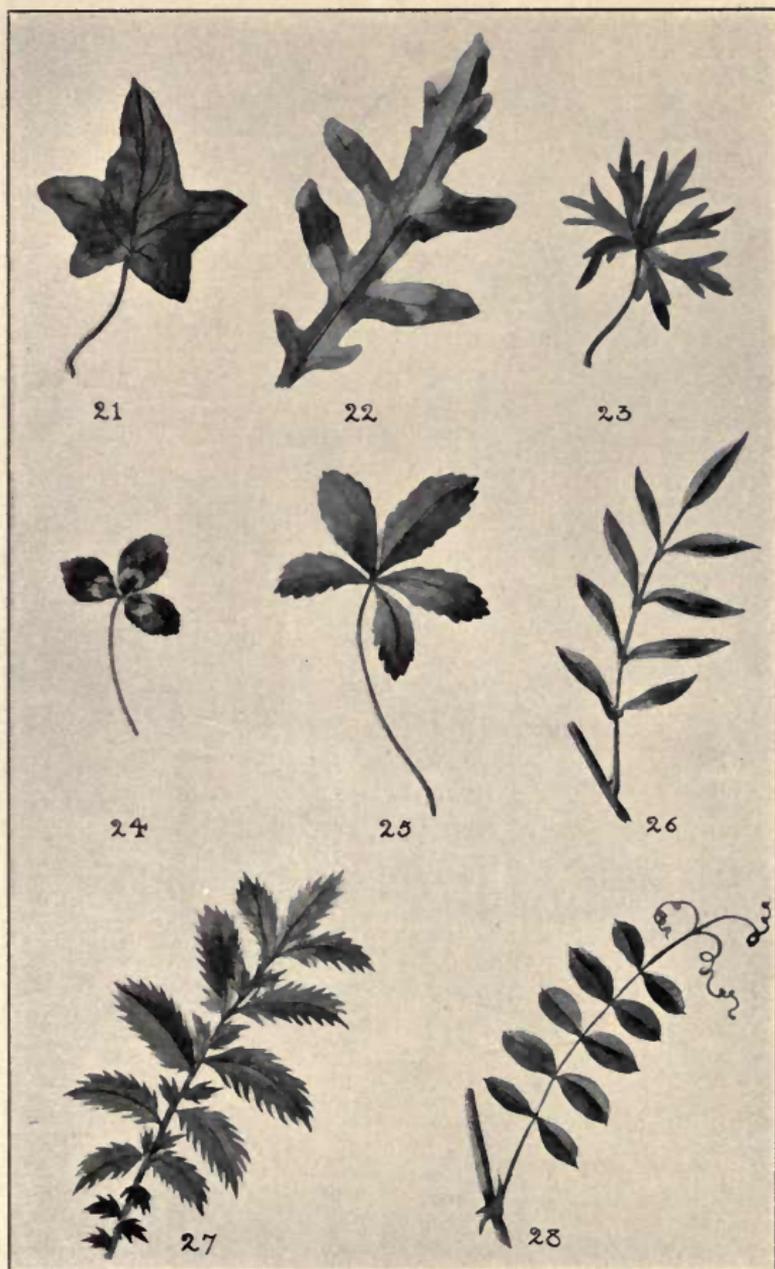


PLATE XVII.—FIGS. 21-28.

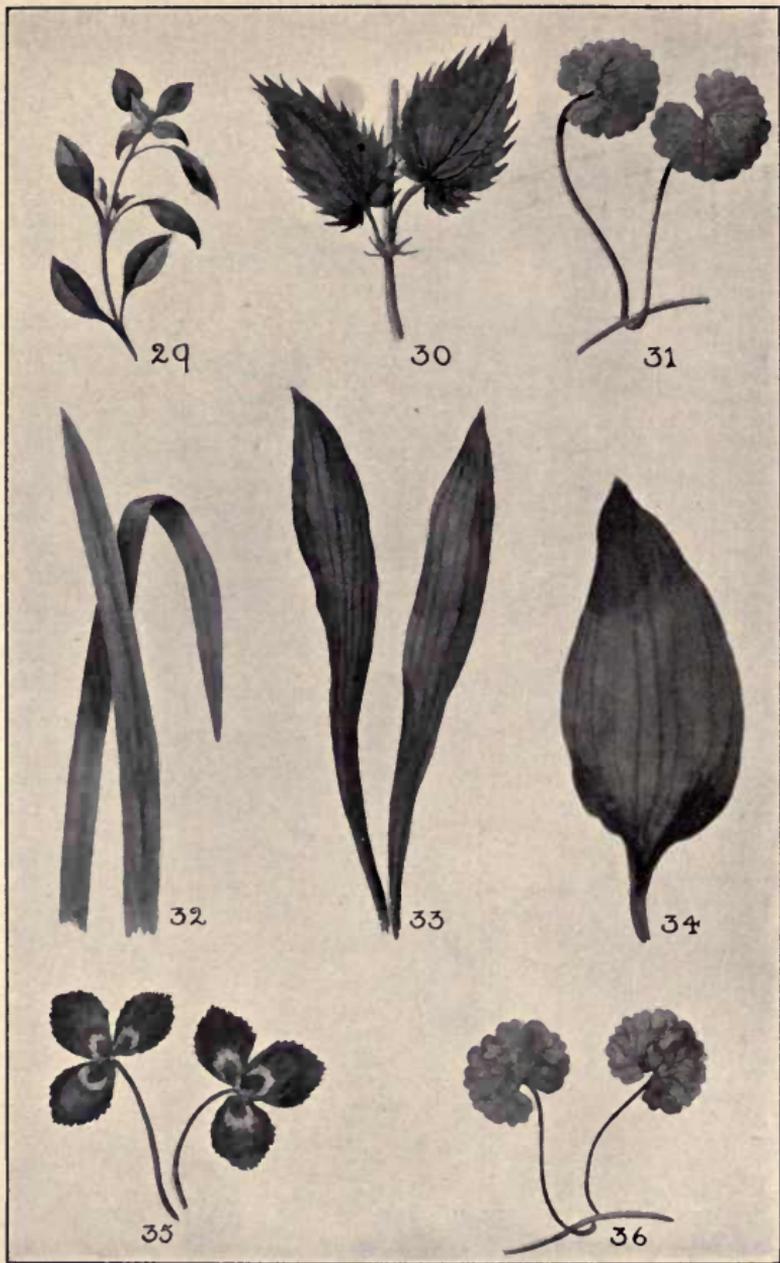


PLATE XVIII.—FIGS. 29-36.

LEAF SHAPES.

Leaves, leaflets, and other flat organs of plants may be—

Linear, narrow; at least four times as long as the width and with parallel margins. (32)

Lanceolate, lance-shaped; broadest about the middle and tapering at both ends. (33)

Ovate, egg-shaped; the larger end at the base. (34)

Obovate, inversely egg-shaped; the larger end at the top. (35)

Reniform, kidney-shaped. (36)

Cordate, heart-shaped. (37)

Obcordate, inversely heart-shaped. (38)

Sagittate, when the base is shaped like an arrow-head, the lobes taking a downward position. (39A)

Hastate, when the lobes at the base of the leaf point outwards in the form of a halbert. (39B)

(Many sagittate leaves vary to hastate on the same plant.)

SCALES, BRACTS, AND STIPULES.

Scales are small organs, generally sessile, having a superficial resemblance to leaves. They are seldom capable of the same functions, and generally differ in color and texture. When serving to protect young shoots they usually overlap like the scales of a fish or the tiles of a roof.

This arrangement is known as *Imbricated*.
(40)

Bracts are small upper leaves on the flower-stem, sometimes only those immediately below the flower. They are generally sessile, and also differ from the other leaves in shape and arrangement, and often in color. (41)

A *Spathe* is a bract enfolding the flowers of certain plants. (42)

An *Involucre* is a ring of bracts round the base of a flower cluster; or it may consist of many rings closely overlapping each other round the base of a flower-head. (43, A and B)

Stipules are leaf-like appendages found at the base of some leaf-stalks, at times very like

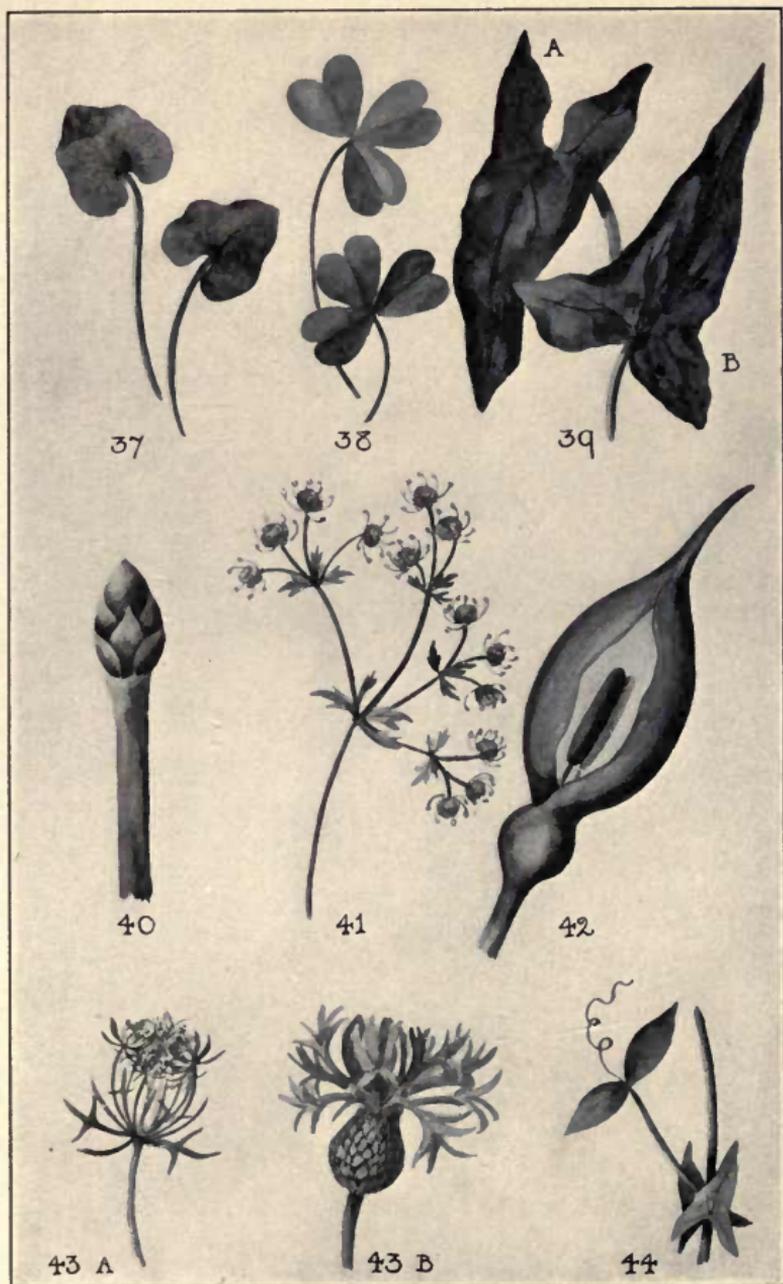


PLATE XIX.—FIGS. 37-44.

the true leaves in shape, but often entirely different. (44)

INFLORESCENCE.

The Inflorescence is the manner in which the flower-stem and its flowers are arranged.

A *Peduncle* is a flower-stem bearing either a solitary flower or a cluster. (45, A and B)

A *Pedicel* is the final branch of the inflorescence, the stalk supporting each separate flower on the peduncle. (46)

VARIETIES OF THE INFLORESCENCE.

A *Spike* is an elongated cluster of stalkless (sessile) flowers. (47)

A *Raceme* is an elongated, unbranched cluster of stalked flowers. (48)

A *Panicle* is a branched or compound raceme. (49)

A *Head* has a number of stalkless flowers, or florets, packed closely together on a common receptacle. (50)

An *Umbel* has several pedicels of similar length springing from a common center, like the spokes of an umbrella.

A *Simple Umbel* bears a single flower on each pedicel. (51)

A *Compound Umbel* bears a secondary umbel (or umbellule) at the top of each pedicel. (52)

A *Corymb*, unlike an umbel, has its pedicels starting from various points on the peduncle, but all terminate at the same level. (53)

THE FLOWER.

The Flower and the Fruit are the *Reproductive Organs* of plants, for they produce the seed.

A *Complete Flower* has four kinds of floral organs, called Whorls—Calyx, Corolla, Stamens, and Pistil. When these organs are able to perform their proper functions the flower is also called *Perfect*. If one or more of these organs is missing, the flower is *Incomplete*, or if, for any reason, they fail to perform their special functions, *Imperfect*.

Some botanists reserve the term *Imperfect* for the lack of one of the two essential organs only, namely, the stamens or pistil.

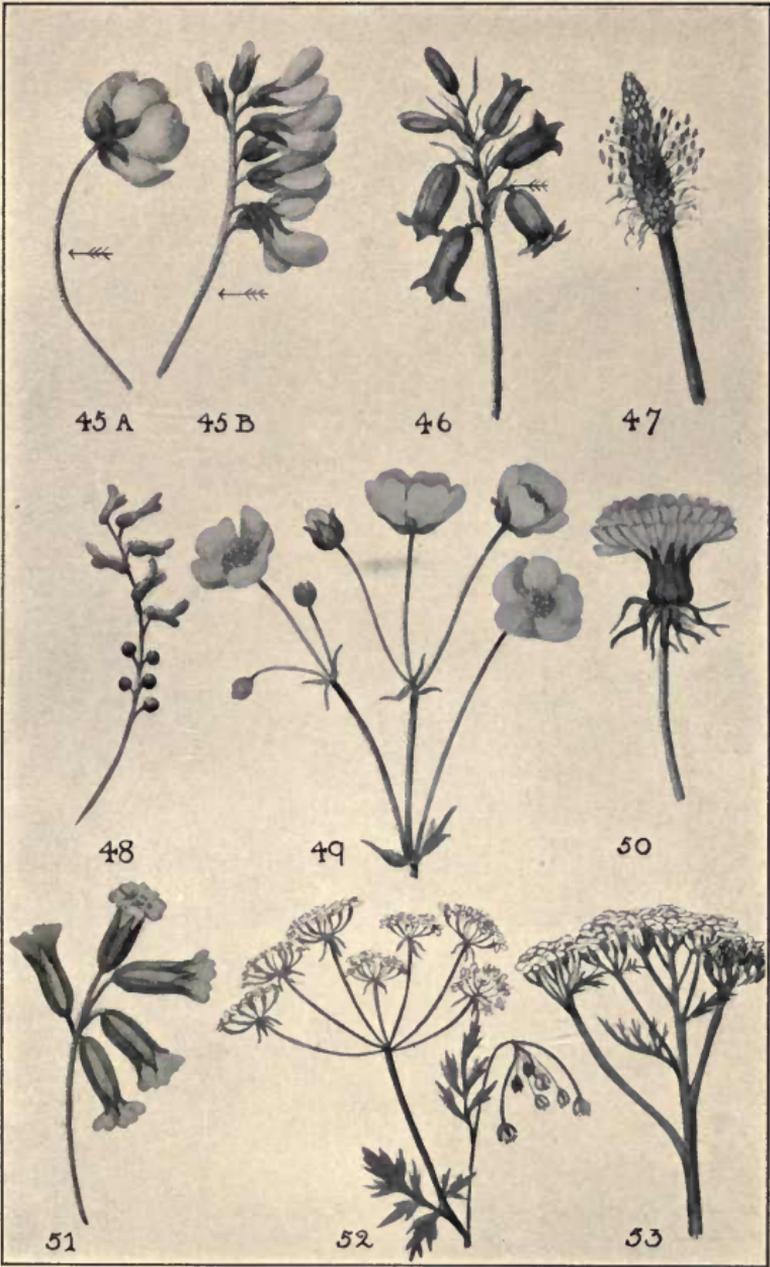


PLATE XX.—FIGS. 45 A-53.

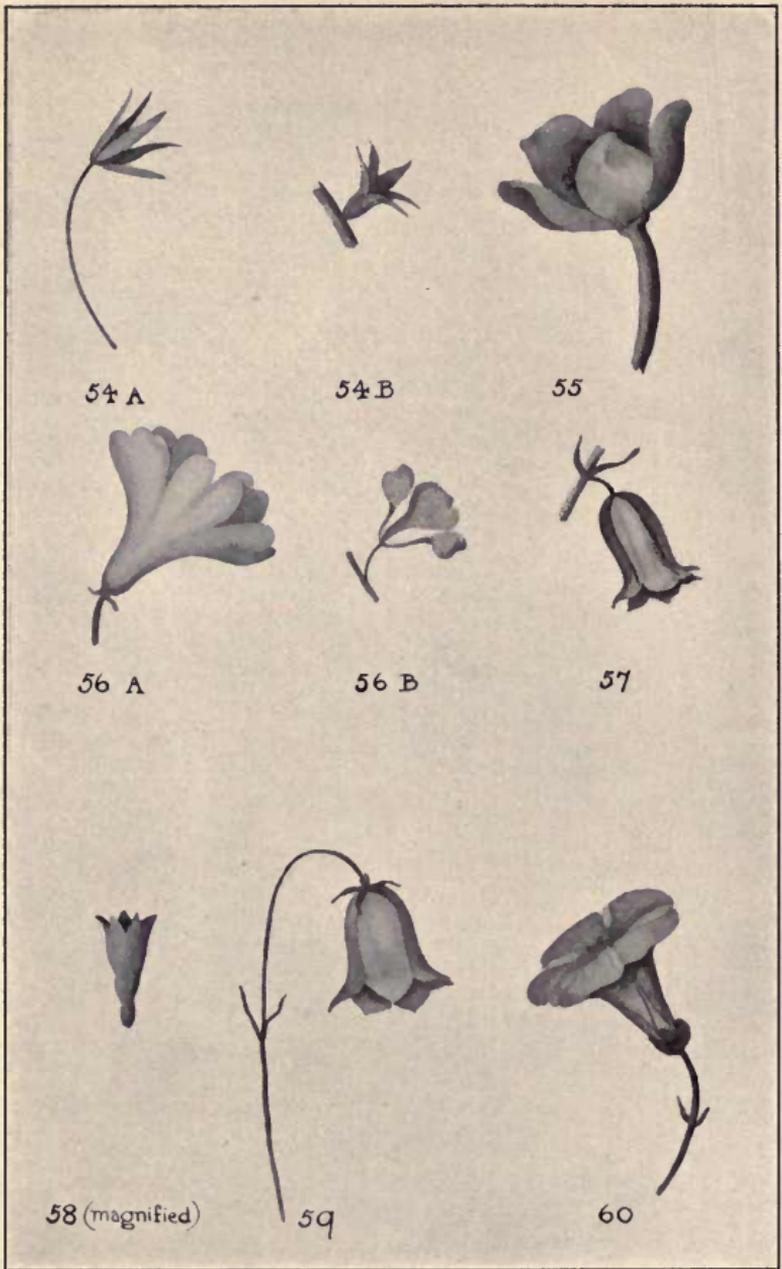


PLATE XXI.—FIGS. 54 A-60.

THE CALYX.

The Calyx is the outer or protective whorl. Its parts, whether separate from each other or partially united, are called *Sepals*. They are usually green. (54, A and B)

Petaloid Sepals are white or colored sepals that take the place of petals. (55)

THE COROLLA.

The Corolla is the attractive whorl. Its parts, whether partially united or entirely separate, are called *Petals*. These may be white, colored, plain, spotted, or streaked, and the shape infinitely varied. (56, A and B)

The Perianth is the combination of the Calyx and Corolla. These are often similar in shape and texture and look like a single whorl. (57)

VARIOUS FORMS OF THE COROLLA.

Tubular, in the form of a tube. (58)

Campanulate, bell-shaped. (59)

Funnel-shaped, in the form of a funnel.
(60)

Urceolate, somewhat egg or barrel-shaped,

contracted near the mouth and spreading out again round the rim. (61)

Stellate, when the petals spread out flatly from their base, or near the base, in the form of a star. (62)

Salver-shaped, when the lower portion of the corolla forms a tube and the upper expands horizontally. (63)

Cruciform, in the form of a cross. (64)

Ligulate, strap-shaped. (65)

Papilionaceous, having a fanciful resemblance to a butterfly. (66)

Labiate, lipped. An irregular corolla, bearing two or more unequal divisions called lips. (67)

Spurred, when the base of a petal or the corolla has a pointed, hollow projection shaped like a spur. (68)

STAMENS.

The Stamens make up the third whorl and are the male organs of flowering plants. As a rule the stamen has a stalk called the *Filament*, with, usually, a two-celled *Anther* at the top.



61



62



63



64



65 (magnified)



66



67



68

PLATE XXII.—FIGS. 61-68.

These cells open when ripe to discharge their *Pollen*.

The anther is the essential part of the stamen, which may be sessile (having no filament) and yet be perfect. The length or absence of the filament is always in accordance with the requirements of particular plants, and anthers open in various ways for the same reason. Examples of Stamens: (69, A, B and c)

Stamens having no anthers and anthers containing no pollen are said to be barren. (For the explanation of *Pollen* see Fertilization.)

THE PISTIL.

The Pistil is the fourth and inner whorl and the female, or seed-bearing, organ of flowering plants.

Some plants have a single pistil. (70)

In other plants the term pistil is used collectively of a number of *Carpels*. (71)

Some botanists call each carpel a pistil.

A Pistil or a Carpel consists of three parts, the *Stigma*, *Style*, and *Ovary*. (72)

The Stigma is variously shaped, being sometimes a mere point, sometimes a head, and at other times lobed or divided. Examples of various stigmas: (73, A to F)

The surface of the stigma is either sticky or feathery, so that it may retain the pollen grains that fall upon it. (See Fertilization, p. 172.)

The Style is the connecting tube between the stigma and the ovary, and it is long or short according to the requirements of individual plants. (74, A and B)

Some pistils have several styles. (75, A and B)

If the style is missing the stigma is said to be sessile upon the ovary.

The Ovary is the enlarged portion at the base of the pistil or carpel. It consists of one or more *Cells*, each containing one or more *Ovules* or *Seed-Eggs*. An *Ovary* (sectional cutting). (76)

The shape of the ovary is infinitely varied. If there is no stigmatic surface, or if there is no ovule in the ovary, such a pistil is said to be imperfect, or barren.

All magnified

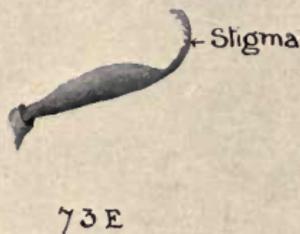
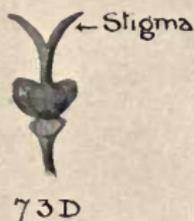
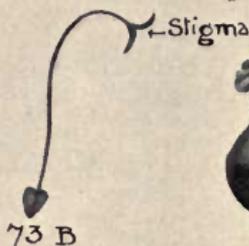
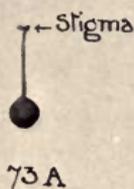
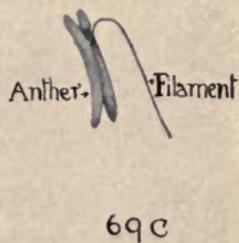


PLATE XXIII.—FIGS. 69 A-73 F.

FERTILIZATION.

Plants are fertilized by pollen falling upon the stigma of the pistil or carpel.

Pollen grains are cells containing fertilizing matter. When highly magnified they are seen to be of various shapes. When pollen grains adhere to the sticky surface of the stigma, or are caught in its hairy surface, they emit long root-like tubes full of fertilizing matter. These are pushed down through the style to the ovary and the seed-eggs are thus fertilized and developed into seeds. The ovary and its seeds gradually enlarge, and when the latter are ripe they are ejected in various ways to start life upon their own account.

Examples of Pollen grains emitting tubes, showing tubes descending. (Both greatly magnified.) (77, A and B)

Pollen is sometimes collected into sticky masses, as in Orchids.

METHODS OF FERTILIZATION.

Self-Fertilization. A flower is said to be self-fertilized when its seed-eggs are fertilized by pollen from its own anthers. (78)

Cross-Fertilization. Many plants occasionally or invariably require pollen from another flower before they can produce good seed. (79)

AGENTS IN CROSS-FERTILIZATION.

Pollen is carried from flower to flower (1) by insects, (2) by the wind, (3) by water, and (4) by birds. Of these the chief agents are insects and the wind.

DIFFERENCES BETWEEN INSECT-FERTILIZED (ENTOMOPHILOUS) AND WIND-FERTILIZED (ANEMOPHILOUS) FLOWERS.

As a rule there is a great difference between insect- and wind-fertilized flowers, both in structure and appearance.

INSECT-FERTILIZED FLOWERS.

The Corolla. This is usually either large, curiously shaped, attractively colored, spotted, streaked, or sweetly or disagreeably scented, according to the taste of the insects required to cross the flower. Some white and pale yellow flowers open only at night to attract night-flying insects, and for the same reason some flowers are more strongly scented then.

Tiny flowers fertilized by insects are generally massed together to attract greater attention.

The shape of the corolla frequently has much to do with its fertilization and in some cases this is specialized to such an extent that certain flowers can only be fertilized by certain insects, and a dearth of these would bring about a corresponding dearth of the flowers.

Some corollas are open to the sky and very easy of access. (80)

Others, growing from the sides of stems in a more or less dense cluster, have developed a large lower petal. This protrudes so as to form a convenient alighting platform for insects in search of honey in the throat of the flower. The upper petal forms a hood over the stamens and thus protects the pollen from moisture which would injure it. In searching for honey, the insect shakes the stamens and this releases the pollen, so that it falls upon the insect's back and is rubbed off later on the stigma of another flower. (81)

Flowers with very long throats require crossing by long-tongued insects. (82)

Flowers that require the services of small flies are generally flatly open, and when they secrete honey it is not far to seek. (83)

The secretion of honey is a great attraction in insect-fertilized flowers; but many plants possessing no honey are visited for the sake of their pollen, some of which is eaten, some stored, and some dropped on to the stigmas of other flowers.

The Stigma. The stigmas of insect-fertilized flowers are variously shaped, but they are more or less smooth and sticky. (84)

Pollen. The pollen is often heavier and moister than that of wind-fertilized flowers. When magnified it is also seen to be rough and spiky, so that it may easily stick to the hairy bodies of insects and later adhere to the sticky surface of the stigmas. Pollen-grains (both greatly magnified.) (85)

WIND-FERTILIZED FLOWERS.

The Corolla. This is usually small, inconspicuously colored and without scent or entirely absent. (86)

Such flowers frequently bloom before the

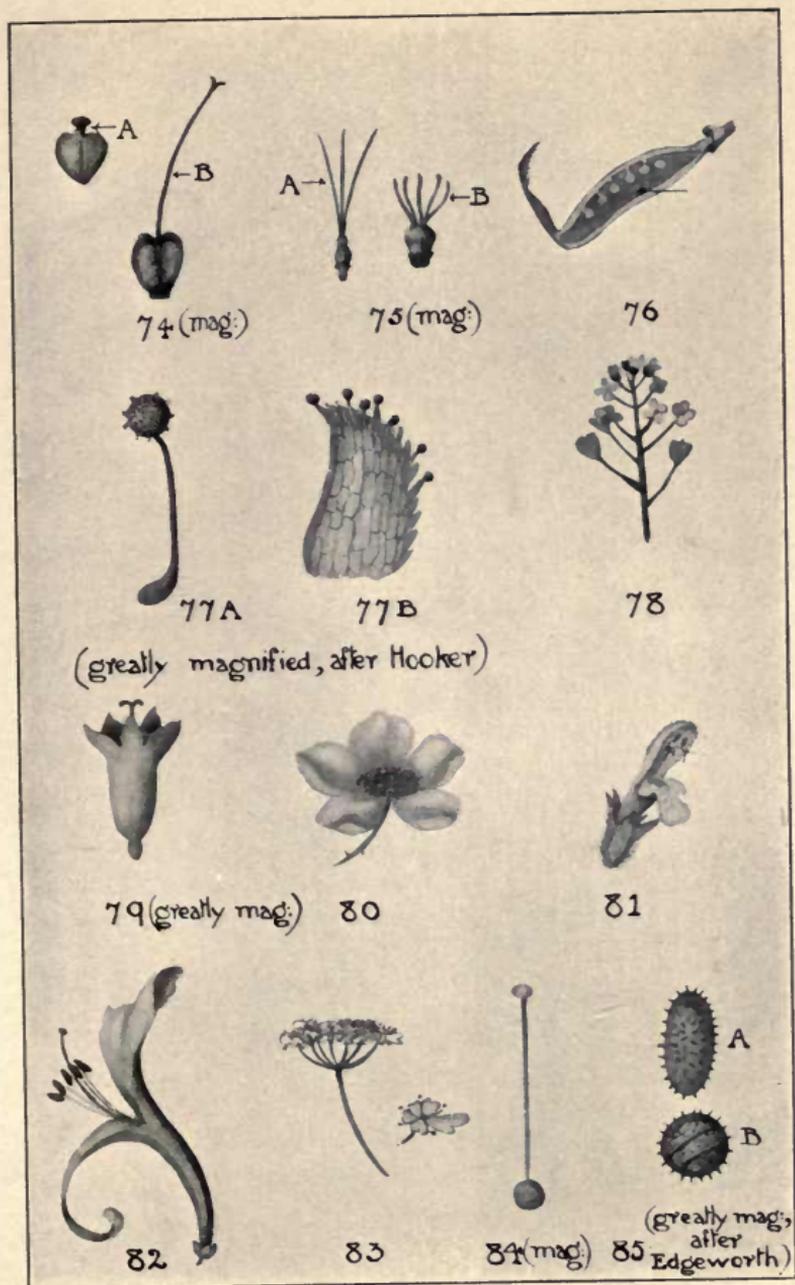
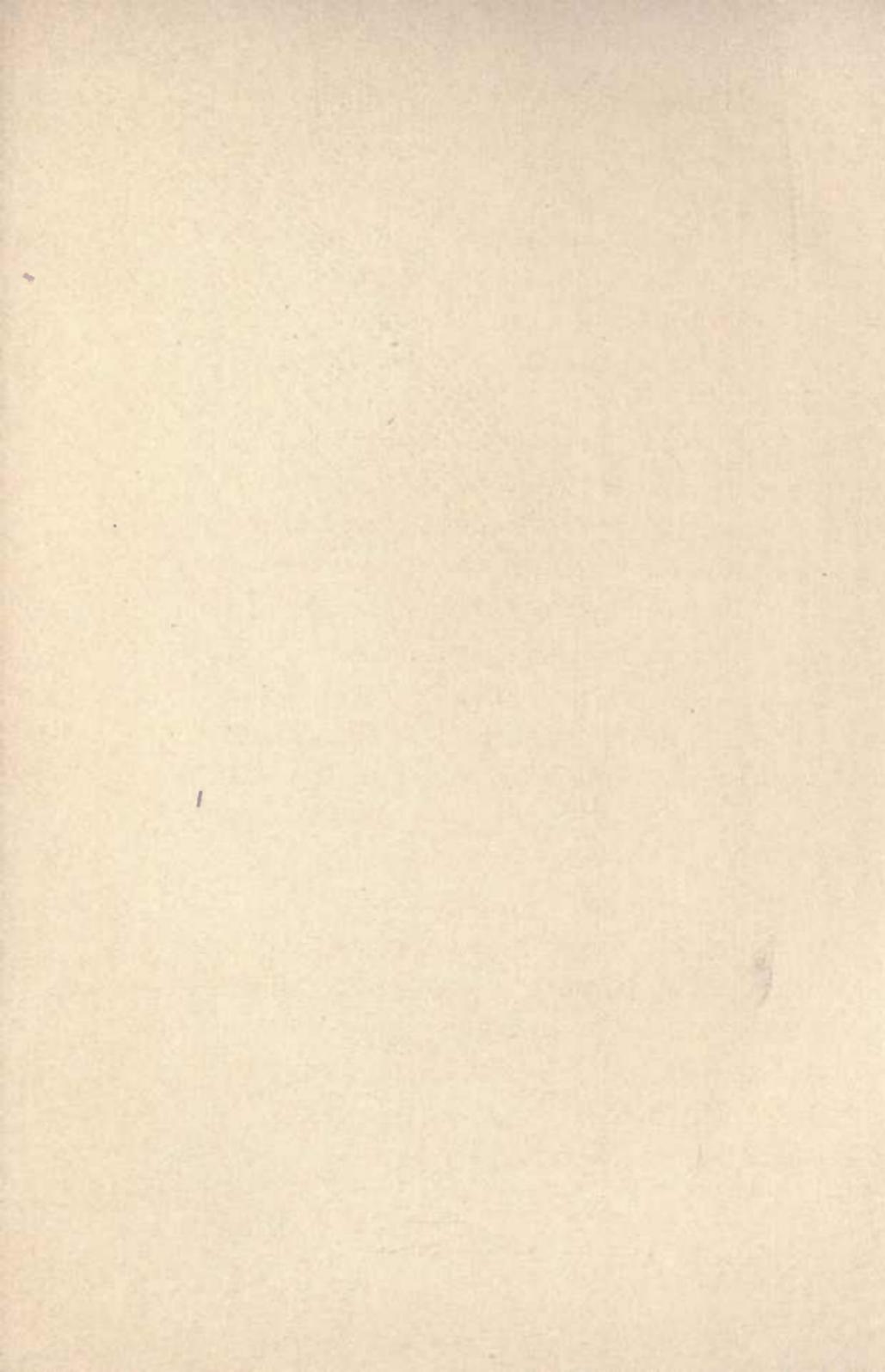


PLATE XXIV.—FIGS. 74-85.



leaves so that the pollen may be swept more easily from flower to flower in the strong winds of early spring. Some are high up on trees, where pollen clouds are unchecked in their progress and many dangle in clusters from slender peduncles that are easily swayed by the wind. (87)

The Stamens. Whether the flowers are upright or suspended, the stalks (filaments) of the stamens are generally long and slender, and they hang far out from the corolla so that the wind may shake their anthers. The anthers are also more or less pendulous. (88)

Pollen. This is generally lighter, drier, more powdery and more abundant than in insect-fertilized plants. When magnified the grains are found to be smooth, with flattened sides, so as to present as much surface as possible to the wind. (89, A and B)

The Stigmas. These are generally feathery, so as to catch and entangle some of the pollen grains blown about by the wind. (90, A and B)

As a rule wind-fertilized flowers produce no honey.

In most cases the stamens and pistils of

wind-fertilized plants are in separate flowers. Those bearing stamens are called staminate or male flowers, those bearing the pistils, pistillate or female.

Some plants (known as *monœcious*) bear male and female flowers on the same individual.

Others (*diœcious*) bear male and female flowers on separate individuals, some plants of a species being entirely male and others entirely female. (91, A and B)

Some wind-fertilized flowers are visited by insects because of their abundant pollen, but these visitors to the male flowers seldom effect fertilization, as the female flowers are too insignificant to attract their attention.

DEVICES FOR PREVENTING SELF-FERTILIZATION.

Flowers that require crossing before good seed can be set have many devices for preventing, or lessening the chance of their pistils being fertilized by the surrounding stamens.

In some cases the flower's own pollen is absolutely ineffectual when it does fall upon the stigma. In others the stigma and stamens are

situated in separate flowers either on the same plant or on different plants (see definition 91).

In some the anthers mature and shed their pollen before the stigma has matured to receive it. Such flowers are said to be *proterandrous*. (92)

In other plants (but this is less frequent) the stigma ripens first, is fertilized by pollen from other flowers, and dies down before the anthers come to maturity. Such flowers are said to be *proterogynous*. (93)

In some flowers the anthers open on the side farthest away from pistil. (94)

Some species have two distinct kinds of flowers always borne on separate plants. (95, A and B)

In 95 A the stamens are half-way down the corolla tube, but the style is long and the stigma peeps out at the top.

In 95 B the positions of stamens and pistil are reversed.

Neither plant is self-fertilizing. Every long-styled flower must be fertilized by pollen from a short-styled flower and vice versa. In 95 A no pollen can fall upon the stigma from

the flower's own stamens, for they lie beneath it. In 95 B the stamens are above the stigma, but their pollen cannot effectually fertilize the ovules. Even the pollen differs in the two flowers. Pollen grains from the long-styled flower are small and their tubes short, since they have only a little distance to travel down the short style of the other kind. Those from the short-styled flower are larger, with longer tubes to enable them to reach the ovary at the base of the long-styled flowers.

ADAPTABLE FLOWERS.

Some species are able to fertilize themselves should they fail to receive pollen from other flowers. (96)

MALE AND FEMALE CONDITIONS OF FLOWERS.

Flowers bearing both stamens and pistil and ripening these at separate times are said to be either in the *male* or *female condition* according to the organ that is mature at any given time. (97, A and B)

In 97 A the flower is in the male condition, and shows three ripe stamens and two not yet

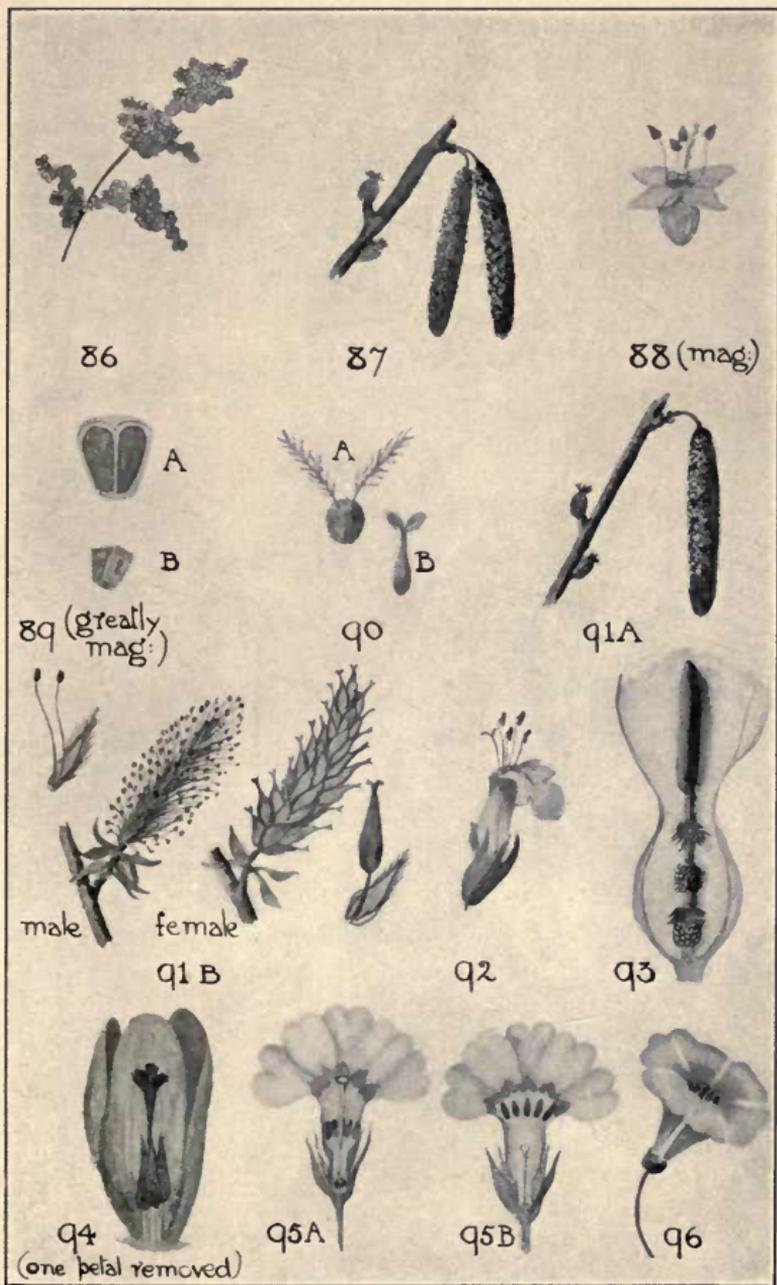


PLATE XXV.—FIGS. 86-96.

matured. The stigmas have not appeared.

In 97 B the flower is in its second and female condition. The stamens have matured and fallen away and the stigmas have come to maturity. (See definition 92.)

Some flowers are first female and later male, but this order of things is not so frequent as the reverse. (See definition 93.)

Flowers are said to be—

Bisexual or *Hermaphrodite* when stamens and pistil are present and perfect.

Unisexual when either all male or all female.

Plants are said to be—

Monœcious when some flowers are male and others female but both kinds occur on the same individual.

Diœcious when the male and female flowers are found on separate individuals.

Polygamous when male, female and bisexual (or hermaphrodite) flowers occur on the same individual, or on separate individuals of the same species.

DEVICES FOR PREVENTING THE ENTRANCE OF
INSECTS UNABLE TO FERTILIZE THE FLOWER.

Plants have many devices for preventing the entrance of insects too small or otherwise unable to fertilize their flowers.

Some insects are too light to shake the pollen out of the anthers, others so smooth that little pollen would attach to their bodies, and some so small that they could crawl into the flowers, rob them of their honey and creep out again without effecting fertilization.

Hairs at, or in, the throats of flowers prevent the ingress of small insects. (98)

Hairs and sticky glands on the stems or calyces of plants are also obstacles. When such hairs are magnified they are often seen to be clubbed, branched or hooked. (99, A and B)

Bristly spines or recurved teeth on the bracts protect the florets in some genera of *Compositae*. (100, 101)

THE FRUIT.

The Fruit consists of the ovary with its contained seeds and any other adhering parts of the flower that remain and enlarge after the fertilization of the seed-eggs. (102, A, B, and C)

Single Fruit is the fruit of a single flower, whether as the result of a single pistil or of many carpels in one flower. (103)

Aggregate, the fruit cluster resulting from several flowers. (104)

If bracts remain under a fruit when its seeds are ripe they are counted as part of the fruit.

Sometimes the summit of the flower-stem (*Receptacle*) becomes swollen and juicy, as in the strawberry. When this falls with the ripe fruit it is said to be a part of it. The fleshy part of the Apple is the swollen receptacle enveloping the ovaries.

The calyx often remains when the fruit is ripe; the corolla very seldom. The stamens sometimes remain in a withered condition, while the style either falls away, remains as

a spike on the fruit, or develops into some appendage to it.

The Pericarp is the envelope of the seed or seeds. It is sometimes called the *Seed-vessel*. It does not include the seeds themselves or any receptacle or calyx that may remain and surround it. (105)

Fruits may be dry, or fleshy and juicy.

Fruits are said to be—

Dehiscent, when opening at maturity to release the seeds. (106)

Indehiscent, when they do not open, but fall with the contained seeds. (107)

Most juicy fruits fall in this way.

VARIOUS KINDS OF FRUITS.

The Pod is long and narrow and when ripe the pericarp splits longitudinally up both sides. (108)

The Silique (plural, *Siliques*) is a two-chambered pod. (109)

Silicle, a short, broad, two-chambered pod. (110)

Capsule, another form of dry seed-vessel

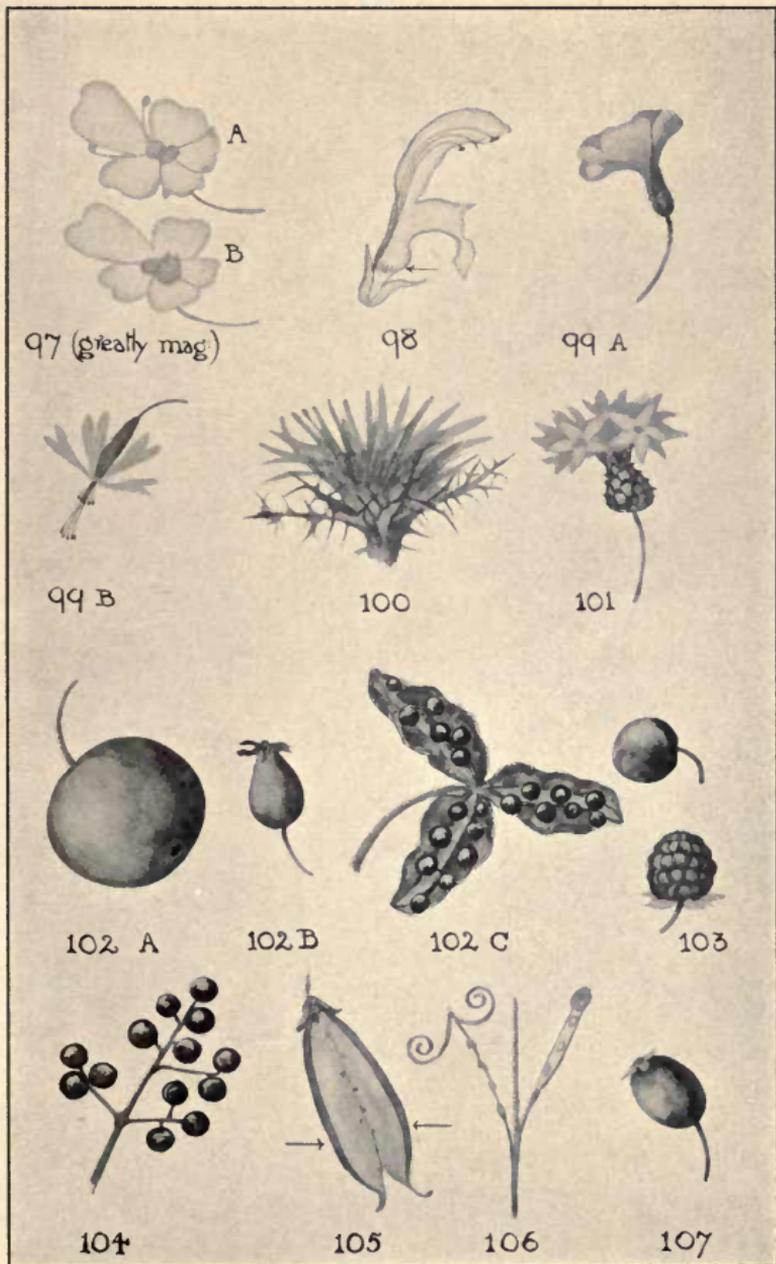


PLATE XXVI.—FIGS. 97-107.

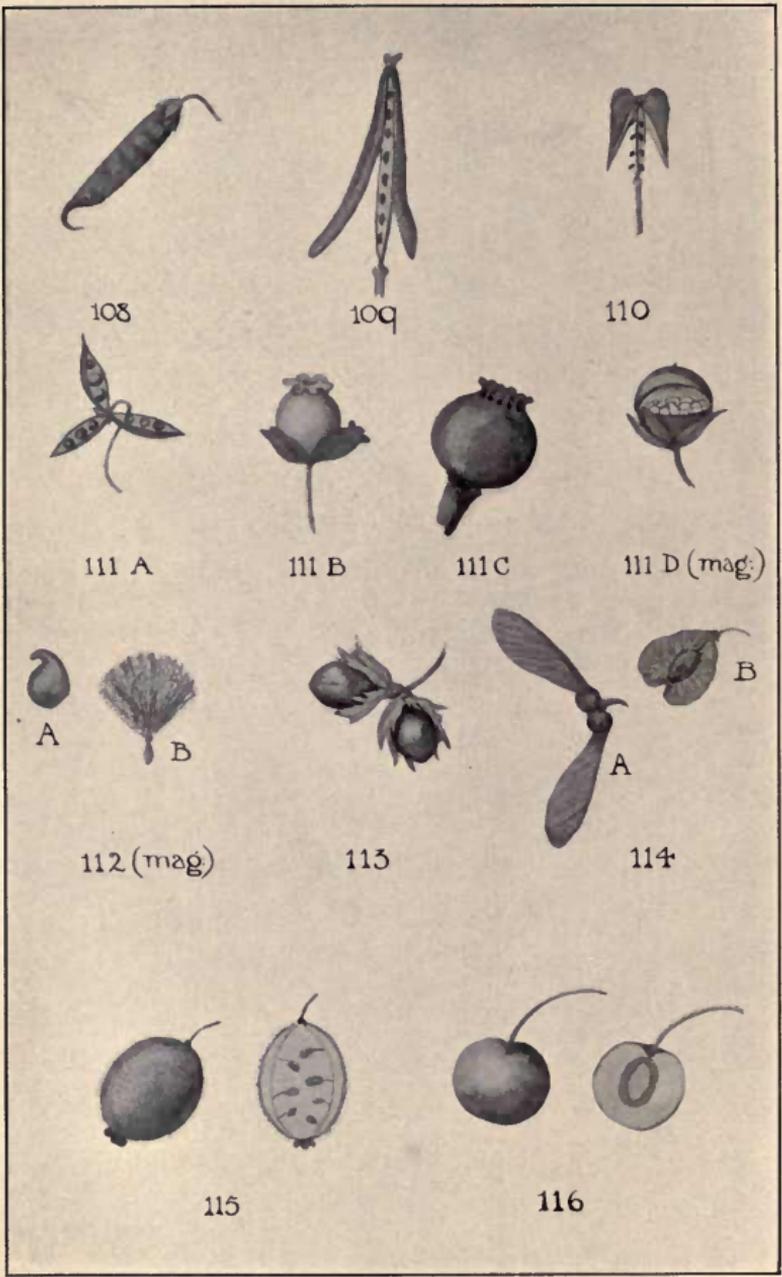


PLATE XXVII.—FIGS. 108-116.

opening by valves, by teeth, by pores, or by splitting latitudinally. (111, A-D)

Achene, a dry, single-seeded fruit. (112, A and B)

Sometimes the calyx remains upon the fruit in the form of a tuft of silky hairs (Pappus).

Nut, a dry, single-seeded fruit covered by a hard shell. (113)

Samara, a nut with a membranous appendage or wing attached to it. (114, A and B)

Berry. In this fruit the seeds are embedded in the soft, pulpy pericarp, which is protected by a soft outer covering of thin skin. (115)

The Drupe has an outer covering of skin, but the inner part of the pericarp has become partly hard and woody (forming a stone, within which is the seed) and partly fleshy. The Drupe is often called a *Stone-fruit*. (116)

THE DISPERSAL OF FRUITS.

Plants have many wonderful contrivances for dispersing their fruits and so preventing the seeds falling into ground already occupied.

Dispersal by the Wind.

By Pappus. Some fruits have silky hairs attached to them. (117)

By Awns. Others have feathery awns. When released they sail on the wind and are frequently carried and dropped far from the parent plant. (118)

Some fruits are very small, light, and flat, and these are easily swept along by the wind.

Winged fruits. Others have wings that act as sails and carry them far from where they grew. (119, A and B)

Dispersal by Animals.

Hooks, hairs, prickles. Some fruits are covered with hooks or prickly hairs, which easily attach themselves to the feathers of birds or to the hairy bodies of cows, horses, rabbits, rats, and other animals that brush past the plants. (120, A and B)

Glowing color and juicy pulp. Some fruits are conspicuously colored to attract birds, who eagerly devour the attractive pericarp; but as the seeds are too hard to be digested, these

are dropped after being carried far from the parent plant. (121)

Shooting Seeds.

The styles and carpels of some plants dry, contract, and curl up when the seeds are ripe, and, separating at the base, shoot the seeds out from the plant. (122)

The fruit of many umbelliferous plants is shot away by animals brushing against the dry, stiff stalks, which, by swinging back again into place, jerk off the loosely attached fruit. (123)

The Poppy shakes its seeds out from the pores or windows of its capsule either by the wind swaying the long, slender stalks or by animals brushing against them. (124)

The pods of some plants split open, and as the two valves part and curl, the seeds are ejected. (125)

THE SEED.

The Seed is the matured ovule. It consists of an *Embryo* (or young plant) and a *Covering*, usually of two coats. The seed also very

frequently contains *Albumen*. Sectional cutting of a seed. (126)

The Embryo is the rudimentary plant, and when fully formed it consists of one or two Cotyledons (or seed-leaves), a *Plumule* (or bud of a stem), and the *Radicle* (or origin of the future root). (127, A to D)

A. Embryo of Bean split open.

B to D. The plantlet at later stages.

Monocotyledons are plants whose embryos have only one seed-leaf or cotyledon.

Dicotyledons are plants whose embryos have two seed-leaves.

The Covering or shell of the seed generally consists of two coats. The *Testa* is the outside coat and the principal one. It may be hard, crusty, woody, or thin and skin-like. The *Tegmen* is the inner coat of the seed.

The Albumen is the embryo's food-store.

THE CLASSIFICATION OF PLANTS.

Plants are divided and subdivided into groups according to the number of features they have in common. All plants and groups of plants have their names. These show their

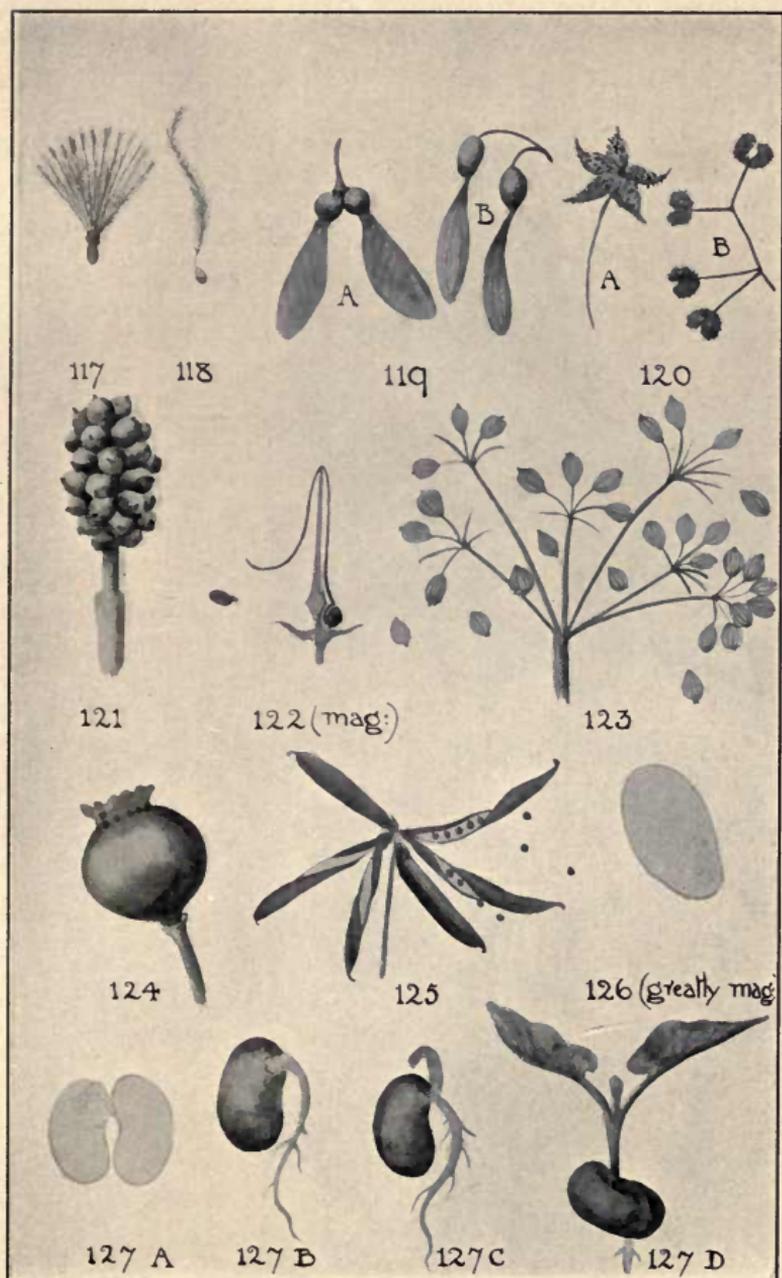


PLATE XXVIII.—FIGS. 117-127 D.

relation to each other and facilitate reference to particular plants. As Latin and Greek are the languages universally acquired by educated people, they are the ones chiefly used in Botanical nomenclature.

The terms in most frequent use for this purpose of classification are *Variety*, *Species*, *Genus*, *Family* and *Order*.

A *Species* is a group of plants so like one another that we suppose them to have descended from a common parent. *Trifolium pratense* (Red Clover).

(That is, all Red Clovers form one species.)

A *Variety*. When a number of plants in a species are unlike the rest in one or more minor particulars these unlike plants form a *Variety*.

A *Genus* is a group of several or many species resembling each other in important matters of structure.

Trifolium (Clover) including such similar species as Red, White, Rabbit's-foot and Hop Clover. *Polygonum* (Knotweed), including Knotgrass, Lady's Thumb, Smartweed, Tear-thumb and False Buckwheat.

Plants had most cumbersome names years

ago, "Gramen xerampelinum, miliacea, per-tenui ramosaque sparsa panicula" being used to denote a grass known later as *Poa bulbosa*. Linnæus, the great Swedish botanist (1707-78) invented the simple plan of giving each plant a name consisting of two words only, the first a substantive, the second an adjective; the first denoting the genus in which it was placed, the second showing the particular species in that genus. In English the specific name comes first and the generic second. *Trifolium pratense* (Red Clover).

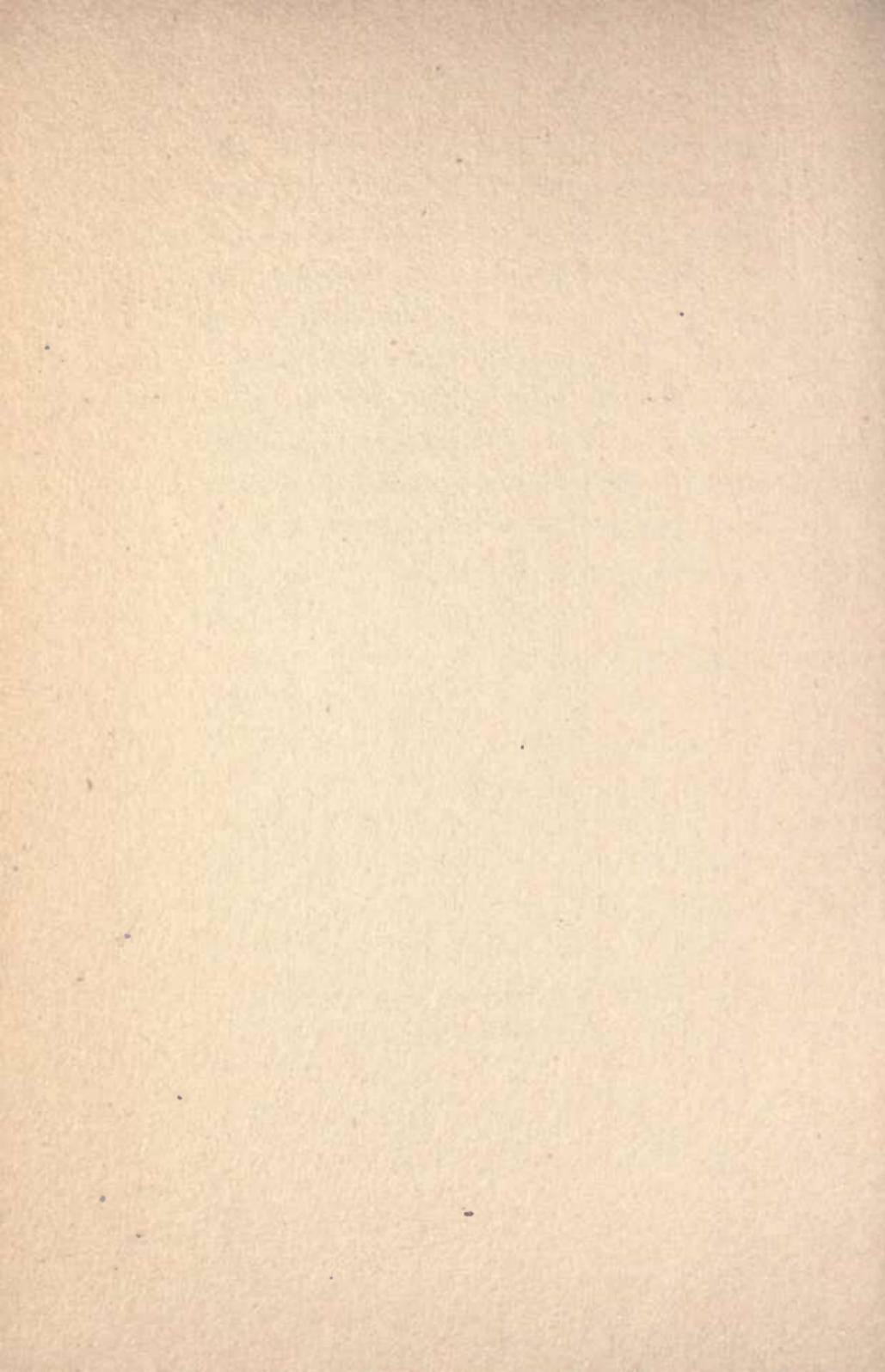
Family. Several or many genera that resemble each other in marked characteristics are grouped into a Family.

Example: Labiatae or Lipped Family, including the Blue Curls, Mints, Skullcaps, Bugles, etc. Umbelliferæ or Umbel-bearing Family, including Wild Carrot, Cow Parsnip, Spotted Cowbane, etc.

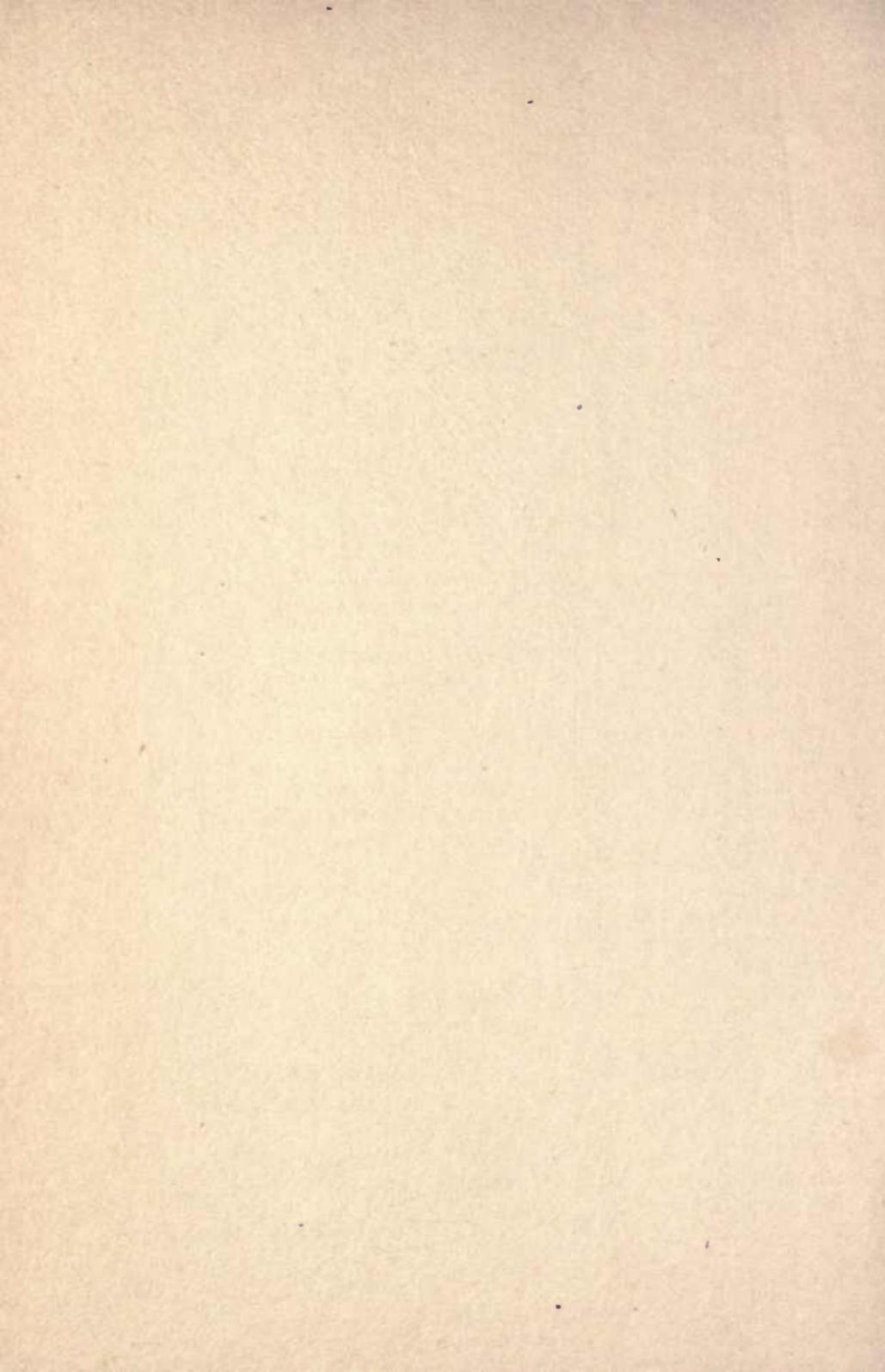
Order. A group of related families. Thus the Pulse, Rose and Saxifrage families belong to the Order Rosales.

Unfortunately botanists are not absolutely agreed about the classification of every plant,

and this causes slight differences in the arrangements of the various Floras published. Some botanists consider the differences between two plants so slight as to constitute the second merely a variety of the first; while others would class each as a distinct species. The same discrepancies occur between the larger groups, but these differences in classification (and consequently in nomenclature) are very few in proportion to the enormous number of plants known to exist.



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