

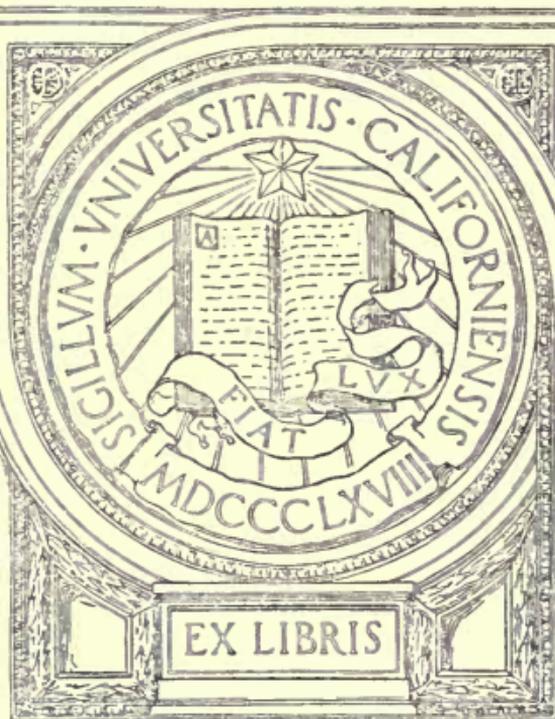
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Some Wild Flowers of Tasmania



BY L. RODWAY, GOVERNMENT BOTANIST

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Illustrations from Photographs by Olive Barnard

Some Wild Flowers of Tasmania

BY

L. RODWAY, Government Botanist

Illustrations from Photographs by Olive Barnard

[*Second Edition*]



HOBART:

JOHN VAIL, GOVERNMENT PRINTER

1922

Some Wild Flowers
of California



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PREFACE TO FIRST EDITION.

THE object of this book is to excite an interest in plants by affording an easy means of studying the structures and affinities of some of our commonest native flowers. In all instances the student should verify the details by dissection of the flowers described. In order to broaden the view some general features dealing with plant life have been touched upon, and where thought desirable repetition has been indulged in.

Miss Barnard is responsible for the illustrations, and her excellent photographs must afford great assistance to the beginner.

The author feels deeply indebted to Mr. Vail and his staff for good advice and much help, and also for the care displayed in producing the book.

Hobart, February, 1910.

PREFACE TO SECOND EDITION.

THE steady demand for this small work has exhausted the first issue. In offering it to junior students a second time it is thought a slight inclusion of further material may be an advantage. There is so much which can be said in illustrating our native flowers that a work of this kind must necessarily be scratchy; it can only be of use in stimulating interest in the study of botany.

Hobart, April, 1922.

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THE PUBLISHER

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NOMENCLATURE.

Popular Names.

Scientific Names.

Ant Orchid	Chiloglottis species
Ants' Delight	Acrotriche verrulata
Bauera	Bauera rubioides, And.
Beech	Fagus cunninghami, H.
" Deciduous	Fagus gunnii, H.
Bitterleaf	Daviesia latifolia, Sm.
Blackboy	Xanthorrhoea australis, R. Br.
Blackwood	Acacia melanoxylon, R. Br.
Blue Flag	Patersonia glauca, R. Br.
Blue Love	Comesperma volubile, Lab.
Bottlebrush, Yellow... ..	Melaleuca squarrosa, Sm.
" " 	Callistemon salignus, D.C.
" Purple	Melaleuca squamea, Lab.
" Dwarf... ..	Melaleuca gibbosa, Lab.
Bramble	Rubus fruticosus, L.
Broom, Native	Calythrix tetragona, Lab.
Buloke	Casuarina suberosa, Otto
" Dwarf	Casuarina distyla, Vent.
Buttercup	Ranunculus species
Butterfly Plant	Utricularia dichotoma, Lab.
Buttons... ..	Cotula species
Cheeseberry	Cyathodes glauca, Lab.
Cherry, Native	Exocarpus species
Christmas Bush	Prostanthera lasianthos
Clovertree	Goodia lotifolia, Sal.
Club Moss	Lycopodium species
Cockatoo Orchid... ..	Caleana major, R. Br.
Cotton Bush	Pimelea nivea
Cowhorns	Pterostylis nutans, R. Br.
Cranberry	Astroloma humifusa, R. Br.
Daisy, Mauve... ..	Brachycome species
" Tree	Olearia species
Dogwood	Bedfordia salicina, D.C.
" False	Pomaderris apetala, Lab.
" Yellow	Pomaderris elliptica, Lab.
Duck Orchid	Cryptostylis longifolia, R. Br.
Eucryphia	Eucryphia billardieri, Spach.
Everlasting	Helichrysum species
Eyebright	Euphrasia species
False Boobyalla	Acacia sophorae, R. Br.
Fly Orchid	Prasophyllum species
Fuchsia, Native	Correa species
Gorse, Native... ..	Daviesia ulicina, R. Br.
Grasstree, Mountain	Richea dracophylla, R. Br.
Greenhood	Pterostylis species
Guitar Plant	Lomatia tinctoria, R. Br.
Gum, Blue	Eucalyptus globulus, Lab.
" Peppermint	Eucalyptus amygdalina, Lab.
" Stringy-bark... ..	Eucalyptus obliqua, L'Her.
" White	Eucalyptus viminalis, Lab.

Popular Names.	Scientific Names.
Hakea	Hakea acicularis, R. Br.
" Small	Hakea microcarpa, R. Br.
" Dagger	Hakea pugioniformis, Cav.
Heart Berry	Aristotelia peduncularis
Heath	Epacris species
Helmet Orchid	Pterostylis cucullata, R. Br.
Hickory	Eriostemon squameus, Lab.
Honeysuckle	Banksia marginata, Cav.
Hop, Native	Dodonaea viscosa, L.
" " 	Daviesia latifolia, Sm.
Horizontal	Anodopetalum biglandulosum, Cunn.
Huon Pine	Dacrydium franklinii
Indigo, Native	Indigofera australis, Willd.
Jack-in-the-Box	Stylidium graminifolium
King William	Arthrotaxis species
Lancewood... ..	Eriostemon squameus, Lab.
Laurel, Native	Anopterus glandulosus, Lab.
Leatherwood	Acradenia franklinii, Kipp.
" 	Eucryphia billardieri, Spach.
Longbeard	Calochilus campestris, R. Br.
Manuka	Leptospermum scoparium, Frst.
Mint Tree	Prostanthera lasianthos
Mistletoe, Native	Cassytha species
Mountain Rocket	Bellenden montana, R. Br.
Musk... ..	Olearia argophylla, F. v. M.
Myrtle	Fagus cunninghami, H.
Myrtle-leaved Acacia	Acacia myrtifolia, Willd.
Native Lilac	Prostanthera lasianthos
Native Olive	Notelaea ligustrina.
Parrots' Food... ..	Goodenia ovata
Parson-in-the-Pulpit	Glossodia major, R. Br.
Pear, Native	Hakea acicularis, R. Br.
" " 	Pomaderris apetala, Lab.
Pincushion... ..	Brunonia australis, Sm.
Pink Boronia	Boronia pinnata, Sm.
" 	Tetratheca species
Pinkberry	Cyathodes acerosa, R. Br.
Pink Orchid	Caladenia carnea, R. Br.
" Spotted Orchid	Dipodium punctatum, R. Br.
Pinkwood	Eucryphia billardieri, Spach.
" 	Beyeria viscosa, Miq.
Potato, Native	Gastrodia sesamoides, R. Br.
Prickly Beauty	Pultenaea juniperina, Lab.
" Mimosa	Acacia verticillata, Willd.
Purple Broom... ..	Comesperma retusa, Lab.
" Heather	Tetratheca glandulosa, Lab.
Quillwort	Isoetes species
Rocket	Epacris lanuginosa, Lab.
Rock Lily	Bulbine species
Running Postman	Kennedy prostrata, R. Br.
Sheoke	Casuarina quadrivalvis, Lab.
Speedwell	Veronica species
Stinkwood	Zieria smithii, Andr.
Spider Orchid... ..	Caladenia patersoni, R. Br.
Star-of-Bethlehem	Burchardia umbellata, R. Br.

Popular Names.	Scientific Names.
Sweet Briar	<i>Rosa rubiginosa</i> , L.
Sweet-scented Acacia	<i>Acacia suaveolens</i> , Willd.
Sundew	<i>Drosera</i> species
Teatree	<i>Leptospermum</i> species
Tiger Orchid	<i>Diuris</i> species
Toughbark	<i>Pimelea</i> species
Trigger Plant	<i>Stylidium graminifolium</i> , Swz.
Turquoise Berry	<i>Drymophila cyanocarpa</i> , R. Br.
Waratah	<i>Telopea truncata</i> , R. Br.
" White	<i>Agastachys odorata</i> , R. Br.
Waxflower	<i>Eriostemon obovalis</i> , Cunn.
Waxberry	<i>Gaultheria hispida</i> , R. Br.
Whitebeard	<i>Leucopogon</i> species
White Flag	<i>Diplarrhena moroea</i> , Lab.
Willow, Native	<i>Acacia verniciflua</i> , Cunn.

SOME WILD FLOWERS.

By L. RODWAY, Government Botanist

Chapter I.

THE FLOWER.

THE name "flower" is a popular one. We know well enough what we mean when we use it, though it might be difficult for us to define. We know it as the first stage of the process by which the plant produces fruit and seed. However beautiful a flower may be, or however sweetly it may smell, we know it is not here simply to please us; it would still bloom if man did not exist. A plant is a distinct living being, and a flower is one of its organs. It has its work to do, just as the leaf and root have theirs, and the ultimate product is seed, and the seed is the embryo of a new generation, just as an egg is the embryo of a new generation in bird life. Examine a flower, and in doing so avoid two sorts: the double flowers so common in the gardens, which are monstrosities produced by cultivation; also such as the Daisy, Aster, and Chrysanthemum, which are compounded of very numerous minute flowers. These are composite flowers, and will be treated in a separate chapter. Choose a simple garden flower or a wild one. It will be seen to consist of outer, usually flat, parts, obviously for protection or adornment, within which are two sets of organs, a circle of little pin-like objects, each with a minute head, surrounding a central body, which little experience teaches us will produce seeds. These two inner organs are the essential parts, and are both necessary for the production of young; the other parts are useful when present, but may be absent without the function of the flower being interfered with. Flowers are of most varied forms; not only do the parts themselves vary according to their kind, but some may be absent. A flower may consist of a single stamen, or only of the innermost organ, but most of the flowers we meet with are what are called perfect; that is, they consist of all the parts of which a flower may be made up.

A perfect flower is formed of a double perianth, a circle of stamens, and a central pistil.

The outer circle of the perianth is the calyx; it is commonly green like the leaves, and made up of three, four, or five parts, each of which is called a sepal. These sepals may be all free from one another or variously united. When the calyx is green and of coarse structure, its duty is evidently that of an outer covering to the bud, while the more delicate organs are being formed within. Sometimes the calyx is not so structured, but may be coloured and delicate when it assumes the duty of the next circle, and may be mistaken for it.

The inner circle of the perianth is the corolla. It is usually coloured and delicate, and made up of three, four, or five parts, called petals, which may be all free or variously united. They may be all equal and similarly constructed, or unequal. When the petals are not all similar the corolla is said to be irregular. As a rule the petals are so inserted that they alternate with the sepals. In most flowers there is a clear distinction between the calyx and corolla, but not in all. Sometimes the passage from one to the other is gradual, and not clearly marked. When the corolla is delicate and brightly coloured its work is evidently to attract attention. It is of first importance to many plants that insects or, in some, birds shall be induced to visit their flowers.

Within the perianth is a circle of stamens. A typical stamen may be likened to a small pin. The shaft is slender and delicate, and is called the filament; the head is round or long, yellow or dark, and is called the anther. A stamen does not look like a leaf, but it is one. Stamens of some flowers are very leaf-like, and in deformed flowers this condition is often reverted to.

The anther, though placed on the staminal leaf, is a separate organ developed there for convenience. It is the direct descendant of the small spore-bearing sacks of lower plants. The anther is made up of four sacks, which may all remain till maturity or they may coalesce in pairs, so that when mature the anther consists of two sacks, or further, all four may blend into one. The anther when mature consists of one or more sacks containing coloured dust. Each particle of this dust is a spore, but in a flower we call it a pollen grain. A pollen grain is a beautiful object under the microscope. It has two coats: the outer one is variously marked, with ridges or spines according to the species; the inner one is very thin, and

contains a fluid of the consistency of the white of an uncooked egg. This fluid and what it contains is a necessary substance required to assist in the production of fertile seed. Stamens vary in number more than do petals or sepals. They may be very few or many, but they are very often of the same number, or twice as many as the petals. They may be all free one from the other, or variously united.

In the centre of the flower is the pistil. It is usually dull or green, leaving the lighter duties of protection and attraction to the outer circles. It attends to the important duty of rearing the young. The pistils of flowers exhibit a greater variety of forms than do either of the other circles. Like them it is made up of few or many units, and just as the unit of a corolla is named a petal, so that of a pistil is called a carpel. A carpel is simply a leaf modified to better fit it to perform its special work. In its simplest condition in flowering plants it is a leaf folded on itself longitudinally till the edges come together and join to form a little bag. On the joined edges inside the bag are developed one or more little round bodies called ovules, which will eventually become seeds. These ovules are the direct descendants of the large-spored sacks found in Pines, some Ferns, and some Lycopods. In the Pines and Flowering plants these large spores are not free and shed as they may be in the others, but are retained within the sack where their presence is obscure.

The upper end of a carpel is usually elongated into a slender column called the style, and at the apex of the style is a variously-shaped receptive surface named the stigma.

The pistil is subject to most varied modifications, according to the species of flower. It may consist of a single carpel, as in Peaflowers, Wattles, Waratah, and its allies; it may consist of many carpels, all free from one another, as in Buttercup, Clematis, Strawberry, or Raspberry; or the carpels may be variously united. When such is the case the union may take place in various degrees, from a simple attachment to one another to a condition where they are so blended that all superficial sign of the separate carpels is lost and the ovarian cavities are merged in one, as in Primula and Pimpernel. Most brightly-coloured flowers produce honey or similar substance of use to insects. This is formed from organs called nectaries, which are variously placed in the flowers according to its kind.

A flower may be considered to be a branch whose leaves have become in the course of time very much modified to suit its special functions, and at the same time the branch from which these leaves arise has been so shortened that they appear to be inserted upon a very short space. This portion of the branch is of such importance, and is so variable in shape that it is necessary it should have a name. It is called the thalamus. In many flowers the thalamus is small and of no noticeable development, but the floral circles arise from it one above the other. In the Buttercup, above the stamens, the thalamus forms a conical projection, upon which are placed the numerous carpels. The Raspberry has a similar projection, but here the base of the thalamus is also developed into a small cup upon the edge of which arise the calyx, corolla, and stamens. In Strawberry we find the same condition, only in fruit the terminal projection enlarges enormously, bearing the little carpels on its surface. In the Rose the thalamus cup is greatly enlarged, and constricted above to form a hollow chamber, at the apex of which are the calyx, corolla, and stamens. The pistil here consists of numerous free carpels growing within and at the base of the cup. They have long slender styles, bearing small round stigmas, which protrude in the centre of the flower. In Guntrees, Ivy and Composites the cup is well developed, but intimately blended with the pistil, so that the other circles of the flower arise above the fruiting portion.

In the ovules are produced the large spores; in the anthers the small spores. An embryo is formed only when the contents of a small spore become mingled with that of a large spore. The pollen is blown or otherwise carried from the anther to the stigma; here it adheres. It grows in an elongating delicate tube through the course of the style, and enters the ovarian cavity. When it meets an ovule it enters it and blends with the contained large spore in which now develops an embryo. The ovule undergoes certain changes, which end in what we call the seed. A seed is an embryo plant enclosed in a tough coat, which enables it to remain dormant, still retaining the power of starting into life when placed in a suitable medium. Some seeds retain this power only for a short period; others for many years. The retention of this power appears to depend largely on the seed coat's resistance to the diffusion of moisture. It appears that in all cases where the embryo loses its contained water beyond a certain degree death ensues.

Many flowering plants have only stamens or pistil in a flower, not both, and the staminate and pistillate flowers may be on one plant or separate ones. This obviously necessitates the arrival of pollen from another flower or plant, in order to fertilise the ovules. This is called cross-fertilisation, to distinguish it from self-fertilisation. When both organs are formed in the same flower it is very common for special contrivance to exist, to prevent self and compel cross-fertilisation.

When flowers are small, dingy, and odourless, cross-fertilisation is effected by pollen being carried by currents of air from the anther to the stigma. This may be observed in grasses and Sheoak. When flowers are brightly coloured or scented, insects visit them in quest of honey, or to gather pollen for food. An insect cannot travel about an open flower without getting dusted with pollen, some of which it will probably leave on the stigma of the next flower it visits.

Chapter II.

THE RANUNCULUS FAMILY.

The number of different species of flowering plants upon the earth is very great indeed, but a careful examination of all the different forms shows us they can be grouped into a few natural families. A family should consist only of plants showing such a likeness of general features that we consider they are related one to another; that is, that they are probably descended from a common ancestor. A like appearance of some parts is not sufficient, as, for instance, the same shaped leaves or similar fruits. No doubt, even in the present day we have not yet succeeded in perfecting this natural grouping, but we are steadily progressing. This grouping of plants according to general character has only one inconvenience: it makes it difficult to the young student. Classification was much easier when it was arranged according to apparent characters, for instance, upon the number of stamens in the flower. As our object is to ascertain truth, convenience has to a large extent to be left out of consideration. A result of natural grouping is that plants which at first sight appear very different, as Buttercup and Clematis, or a Bean and a Wattle, are brought together, while similar looking plants, as Buttercup and Potentil, are kept far apart. No hard and fast rule can be laid down, though the structure of the flower and seed can be most relied upon.

When we wish to talk about any particular family we generally give it the name of one of its commonest members, as the Ranunculaceæ. The peculiar termination of such a word is meant to indicate that we refer to a family and not a genus. Rosaceæ means the family of which Rose is the type; Myrtaceæ, the Myrtle family; Leguminosæ, the legume-bearing family; and so on.

The Ranunculus family, of which Buttercup and Clematis are our commonest forms, bear simple or primitive flowers, which will form a base to enable us to understand the more complex forms. We have only a few species of Buttercup, but they are fairly common, and some of them may be found in flower in most seasons. They are all small herbs with yellow or nearly white flowers, with, in rare instances, tendency to red. Neither the fact that they are herbs, nor that the flowers are generally



FIELD BUTTERCUP.
(*Ranunculus lappaceus*, Sm.)

[See p. 6

yellow, is of consequence from a scientific point of view. Size and habit seldom indicate a different relationship; and colour of flowers, however interesting to a gardener, is of little consequence in botany. These factors may change rapidly in response to a change in surrounding condition; they may be classed as characters of secondary importance, or may even be considered accidental.

If we examine a Buttercup flower we find the perianth is very plainly made up of two circles; that is, there is a distinct calyx and corolla, which do not, as in some plants, pass gradually into one another. Though the members of each circle are usually five, they are not as constant in this as we generally find in flowers; six or more may often be found.

The calyx is green and the sepals are all free from each other, and of very much the same consistency as the ordinary leaves. The work of this organ is very evidently to protect the bud from drying, or from the entrance of water while the delicate inner parts are being formed. It is very common in Buttercups for the sepals to fall off soon after the flower opens. The corolla is made up of free petals, which usually agree in number with the sepals. They are of delicate texture, and are commonly larger and broader, but in some species they may be narrow and small. The petals arise from the thalamus close above the sepals. This is a point that should be noted, as a departure from this is an important feature in the development of more complex flowers. They are inserted into, or, in other words, arise from, the thalamus by a point or very slender attachment, and it should be observed that they alternate with the sepals; that is, each petal occupies the space between two sepals. This is the common, but not invariable, rule in the placing of the members of each floral circle.

The stamens are numerous, free from one another, and inserted close above the corolla. The anthers are closely blended with the filaments, and consist at maturity of two sacks which split longitudinally to allow the pollen to escape. The stamens of a flower are collectively called the androecium, but we will dispense with the use of this word, as we can do without it. The pistil is made up of numerous carpels, which grow upon a conical enlargement of the thalamus. Each carpel is free from its fellows, and consists of a small chamber called the ovary, the top of which is extended into a short, relatively thick and generally bent, style. Towards the end of the style, on its



• FIELD CLEMATIS.

(*Clematis gentianoides*, D.C.)

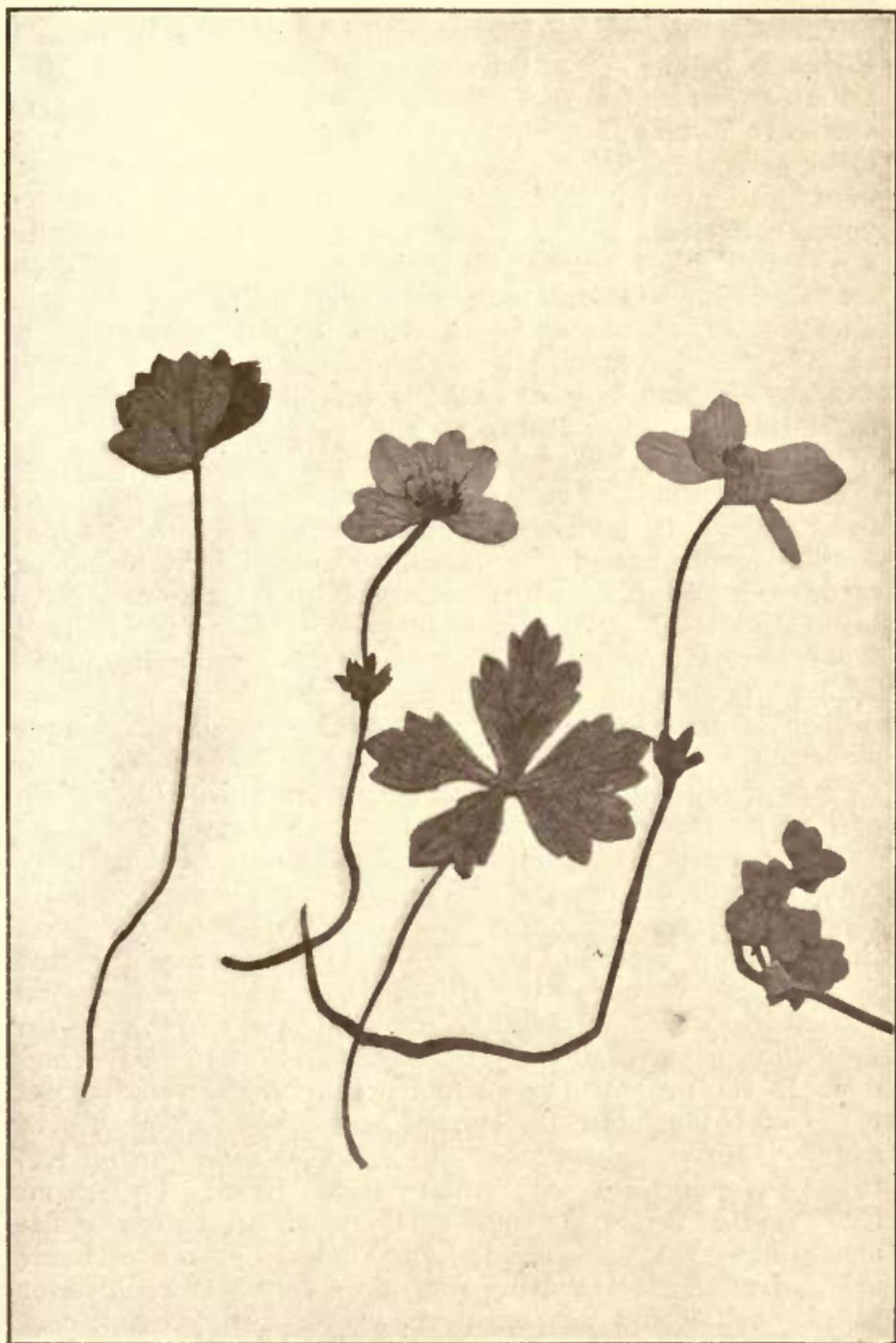
[See p. 10

convex surface, the tissue is softer than the rest, and grows into loose papillæ; this is the stigma which receives and retains the pollen. In each ovary there is a single ovule, which grows erect from near the base. This ovule will, after fertilisation by the contents of the pollen grain, become a seed.

Buttercups are cross-fertilised by flies or other small insects which travel from flower to flower in quest of honey. This honey is here developed on the petals. In most Buttercups may be seen rather below the middle on the upper surface of each petal a little pouch, which contains a small but constant supply of sweet fluid.

The fruit is not much altered. The thalamus grows a little larger, and each carpel grows to accommodate the seed, and becomes harder. The style remains as a modified hook which, by sometimes catching on to the fur of a passing animal, assures the fruit being dispersed to a distance. As only one seed is formed in each carpel, nothing would be gained by the carpel bursting to allow it to escape. In ordinary talk we call the mature carpel a seed, but it is in this instance more than that.

Clematis, though so different in habit, has a flower of very similar construction. In most cases Clematis is a tall climber, clinging to any available support by means of the leaf stalks. These stalks have the unusual power of bending round any object they may touch. They thus do the work commonly done by tendrils. The leaves of Clematis, unlike those of other genera of the family, are arranged in pairs. There is not a calyx and corolla, but only one circle of petal-like leaves. By common consent, where there is only one such organ, though it may be coloured like a corolla, it is called a calyx, and each element is therefore called a sepal, though it may look like a petal. In both our common species of Clematis these sepals are white, and usually, but not always, four. The stamens are long, and their anthers narrow, ending in acute points. The pistil is formed as it is in *Ranunculus*, only the styles are long and clothed with long hairs, giving them a feathery appearance. The single ovule, instead of arising from the base of the ovarian chamber, hangs down from the top. It is common to find in flowers of Clematis that one will bear perfect stamens developing pollen, but the carpels are imperfect, and so it does not develop seed, while others bear perfect carpels but rudimentary stamens. Our common bush Clematis is called *Clematis aristata*, from the aristate or pointed shape of the anthers. The little creeping one



ANEMONE CRASSIFOLIA, Hook.

[See p. 12

is called *Clematis gentianoides*, from its likeness to a *Gentian*.

The *Ranunculus* family, to which both *Buttercup* and *Clematis* belong, is a rather large one, and is well distributed over the face of the earth, but it is poorly represented in Tasmania. We have a single species each of two other genera, *Caltha* and *Anemone*, but they are rare mountain plants, and not likely to be met with by young collectors. As will be seen, the flowers in this family are of a simple type; the portions that go to make up each set of flower elements are arranged spirally above one another on the receptive portion of the stalk. It is an advance in complexity when these are arranged in definite circles. Again, each part is clearly independent of its fellows; for instance, the petals are not united in a tube, as in *Heath*, nor are the carpels joined to form a complex pistil. For these reasons the type of flower in the *Ranunculus* family is considered to be a primitive type; that is, a form that was developed early in the evolution of flowers, and from which more complex forms may have been developed. This does not mean that the modified flowers commonly met with were derived from *Ranunculus*-like flowers in lineal succession, but that they were derived from ancestors showing somewhat similar simple structure. *Ranunculus* flowers seem to have stood still. Environment suited them, and they were quite able to live and pass on descendants without the necessity for change.

This tendency to persistence is common to all parts of both animal and vegetable kingdoms. There is usually room for a limited number of unprogressives, but that limit is easily reached; then the struggle destroys the surplus, except favoured individuals, who have some special advantage which, diverging from the type, enables them to maintain themselves. The result is that in both kingdoms in the present day we find present not only advanced types of beings, but intermixed with them all grades of simpler forms, down to almost the most primitive. Changed conditions exterminate many links. Organisms that would thrive on our earth when it had a dense atmosphere heavily charged with moisture and carbonic acid, when the temperature was never very high, and never at all low, would not exist anywhere with present conditions. No link seems to be more thoroughly obliterated than the early steps in the formation of living bodies.

It must not be concluded from anything said above that all apparently simple flowers are primitive. In the

evolution of flowers two processes have been constantly at work, ever changing and obscuring things. There has been a constant advance in many different lines of descent, from the simple to the complex. At the same time, in all sorts of different genera and families reduction processes have taken place that have tended to reduce flowers from a complex to an apparently simple type. Both the advance and reduction are results which we are obliged for the present to refer to as changes induced in response to changes of environment. These two processes of advance and reduction have not taken place in progressive series, but have constantly oscillated in response to ever-changing conditions. The result is that it is no easy matter to unravel the line of descent of any form. We are constantly grouping together beings whose structure appears to denote a like descent, and very often erroneously. There is always one conservative feature tending to restrain, and that is the possible response the being can make. Every individual plant of one species differs from its fellows. It has its own constitution, with its own limited range of response, and no change of surroundings can cause it to respond in excess of that range. If such is necessary, the only response left to such an individual is to die.

The habits observed in this family, namely, short-lived herbs and long-lived climbers, show that habit is no test of relationship. Some families consist wholly of shrubs, others of trees, while others may contain all conditions. Neither must the shape of the leaves be relied upon. These organs are developed for a special purpose, namely, to increase the extent of green surface exposed to sunlight, and are variously formed according to the possibilities of the plants and the surroundings in which it may find itself. The same shaped leaf may be found in different families, or many shapes in the one. On the other hand, in some cases the leaf may be constant in general features and be indicative of a particular group. The development of leafy structures is of great advantage, and may arise in any plant, whether seaweed, moss, or higher plant, without indicating descent one from the other. It is only an indication that an advantage may arise and be transmitted in any cycle of affinity.

Chapter III.

THE HEATH FAMILY.

This family as originally understood is a very large one, and plants belonging to it are found in most parts of the world. The species are varied in detail, just as its distribution is worldwide, and many are far from the form we commonly associate with a Heath.

In the early part of last century Robert Brown noted that there was one feature which enabled the family to be divided into two natural groups. In one the anther maintained separate pollen chambers, and in most instances dispersed the pollen through pores; in the other the chambers coalesced to form one, and on maturity split along its whole length. The first group is the Ericaceæ, having the genus *Erica* for its type. It also includes the unheath-like *Kalmia*, *Azalia*, *Waxberry*, and *Rhododendron*. The second group having our common Heath, *Epacris*, for its type, is called Epacridaceæ, and includes also our mountain Grass-trees. The *Erica* family is very widely distributed; we have four species, of which *Waxberry* is the commonest. But its principal home is Europe, North America, and South Africa. The *Epacris* family is much more restricted, being almost confined to Australia and New Zealand, a few species only crossing the Southern Pacific.

This latter family, which may be called the Australian Heaths, is the subject of the present chapter. It is a large group, and very common throughout Australia. They are all shrubby in habit. Though some are small, they are not of the succulent, temporary character we associate with the name herb, and though others are tall, they do not assume the proportion of trees. These three names, herb, shrub, tree, are popular names incapable of accurate definition, but they are too useful to be dispensed with. Another feature of interest is that the leaves have always a simple outline; that is, they are never lobed or divided into leaflets, and they are generally narrow, with parallel veins, and of thick consistency. This constricted form and thick structure is very suited to the dry sunny condition of the Australian climate, and will be again referred to.

Our common Heath is one of the most beautiful wild flowers. Though numerous, the flowers are arranged singly

along the branches; each is placed in the axil of a leaf. The axil of a leaf is the upper angle between a leaf and stem or branch. This single arrangement is one of the marks by which the genus *Epacris* may be known, but is not peculiar to the whole family. The stalk of the flower is short, and is clothed with much reduced leaves. Leaves on the flower stalk when changed to assist the flower are called bracts. The calyx consists of five bractlike sepals, which are free from one another and clothe the base of the flower. The corolla is composed of five petals, which are united for the greater part of their length into a tube, the five ends are free and spreading. The tube varies greatly in length in different individuals. The corolla is delicate, and of all shades, from white to dark-crimson. It appears to attract insects, and consequently forms good seed, irrespective of the tint. Therefore the colour of the flower and length of the tube, like many other details in plants, may be considered as accidental circumstances and not accurate adaptations. The corolla arises from the thalamus close above the calyx.

The stamens are five in number, and instead of arising as in *Ranunculus*, they come off from the corolla near the top of its tube. This is not universal in the family. In some genera they arise from the thalamus. The anthers are small, and the single pollen chamber opens along its entire length. The pistil of Heath is very different to what we have seen in Buttercup. Instead of a collection of little free carpels, it appears in a single body in the centre of the flower. It has a spherical part below, and a long, slender, simple style, ending in a little round stigma shaped like the head of a pin. The spherical base of the pistil has not a smooth surface; the top where the style comes off is much sunk, so that it appears to arise from the bottom of a pit, and the surface is marked by five shallow erect depressions. If you cut through the body at its broadest part it will be observed that it is made up of five small cavities, and the depressions mark their boundaries. Each cavity is an ovary, and at its inner angle arise many minute ovules. The pistil of a Heath is therefore made up of five blended carpels, which is apparent is the ovarian portion, but quite obscured in style and stigma.

When the flower withers the fruit is formed. This is not much changed in character. The compound ovary becomes rather larger, and dries. It then bursts along the back of each carpel, to allow the minute seeds to escape. Such a fruit is called a capsule.

Our mountain Grasstrees belong to the genus *Richea*, and it is a pity, where the scientific name is so easy, it is not more universally used. This is all the more desirable in such a case as the present, for the name Grasstree is also given to a very different group of plants, which are also called Blackboy, that belong at the junction of the Lilies and Rushes. Blackboys have very numerous long wiry leaves, arising from the top of the stem, and a long erect central club upon which numerous small flowers are borne.

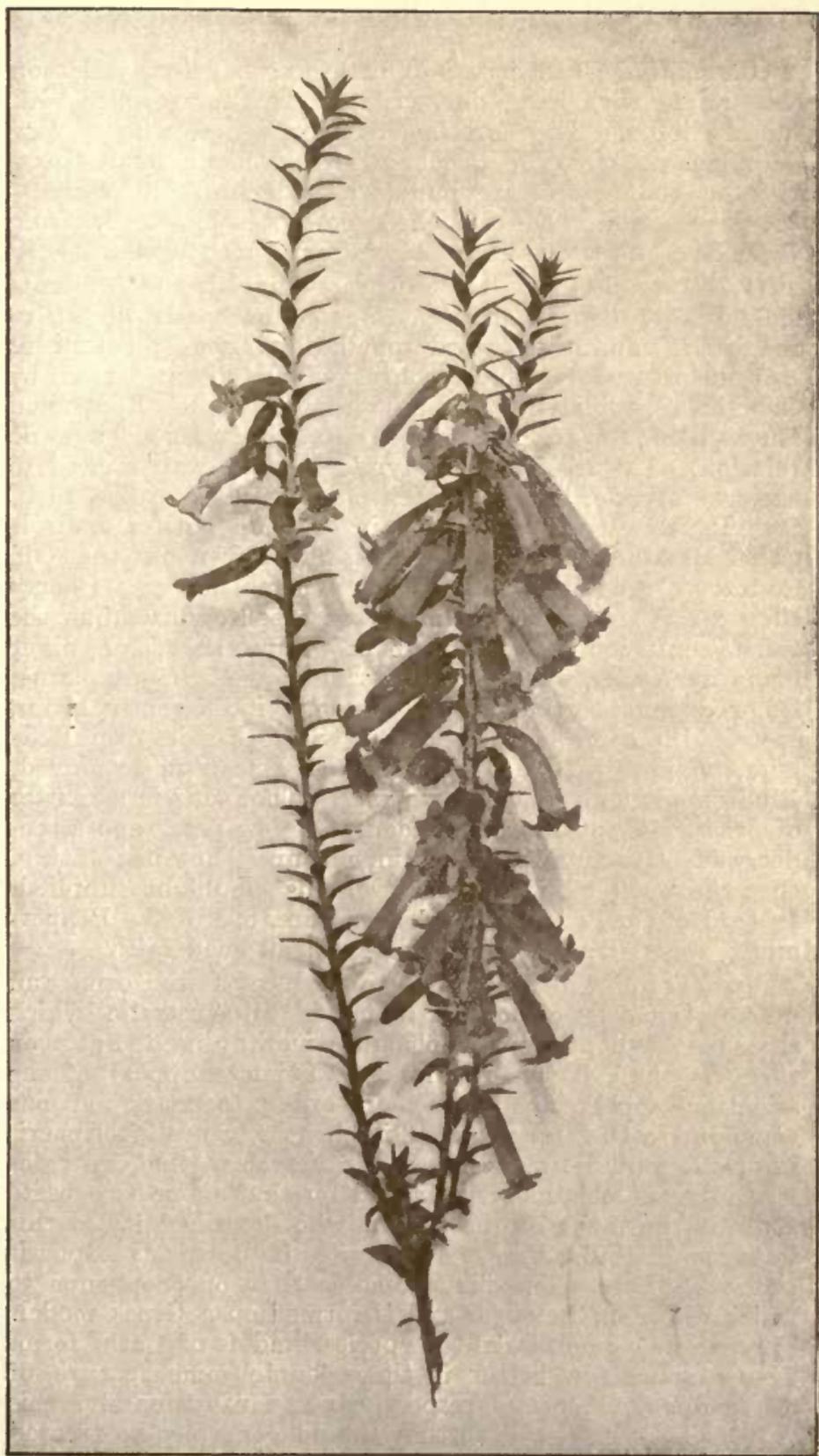
Richeas are very unheathlike in general appearance, but the flowers are of the *Epacris* type. The leaves are relatively broad, and in some cases very long; they always arise from a broad base closely enveloping the stem, which they mark by a circular ring. The flowers are numerous and clustered in bunches towards the end of the stem, each bunch arising in a leaf axil. The corolla is closed above, or has microscopic lobes, and at maturity falls of entire, looking somewhat like a grain of rice. From this, *Richeas* are sometimes called Rice plants. The stamens do not arise from the corolla, but are inserted into the thalamus, so that when the corolla falls the anthers and stigma are exposed to the visit of insects. The flower does not otherwise differ from the type described above.

We have a shrub very common in our bush of a similar appearance to a small-leaved *Richea*, but the petals are persistent and are separate one from the other nearly to the base, and the anthers generally cohere in a ring round the style. It is a *Sprengelia*.

These and a few other genera have capsular fruits and many seeds in each chamber. But there is another and larger section of the family with berry-like fruits, each ovary of which contains only one seed.

The commonest genus of this is that commonly known as the Whitebeards, or *Leucopogon*. The flowers are very small, generally numerous, in axillary or nearly terminal bunches. The corolla is white and the inner surface of the petal lobes are densely covered with white hairs. The fruit is small, and the style is not so sunk in a depression; the outer part is succulent, the inner is a stone with five or fewer chambers, each containing one seed.

Cheeseberry and Pinkberry belong to a genus, *Cyathodes*, with similarly-structured flowers and fruit, only the former are placed singly in the axils, and the petals bear few or no hairs, and the fleshy coat of the fruit is better developed. In Cheeseberry also there are generally ten ovarian cavities.



COMMON HEATH.
(*Epacris impressa*, Lab.)

[See p. 15

Our native Cranberry is a little shrub growing flat on the ground with long, dark-crimson, tubular corollas with minute lobes. The fruit is green or white, with a very succulent outer coat. Peachberry looks like a small *Epacris*, but the flowers are bunched, and the fruit places it in this section. The bunched flowers separate it from *Cythodes*, and the hairless petals from *Leucopogon*.

It is very desirable that at least our commoner plants should have popular names. People naturally object to the difficult and often weird appellations used by botanists. But unfortunately much confusion has been caused by thoughtless application. We have given names of common English plants to our natives, to which they have no relation. The tree we call Myrtle is in no way related to the true Myrtle, but is a Beech, and should be called such. Our Laurel, too, has nothing in common with a Laurel, either as scientifically or popularly known in the Old Country. And our Native Cherry is no nearer a Cherry than a cabbage. These names cause false ideas, but the worst confusion is the result of giving the same plant many names, or, worse still, the same name to many plants. Dogwood and Native Pear are names indifferently given, even in the same locality. Every State has its own Red-gum, while we have in Tasmania two *Eucalypts* so named. Blue-gum suffers in the same way. That this is a matter of practical importance is evident. A few years ago a tender was let to supply Blue-gum, meaning, but not stating, that the wood of *Eucalyptus globulus* should be supplied. Instead of this, another local Blue-gum, one of the Peppermints, was delivered and accepted in all good faith.

An effort is being made to induce a uniform and unexceptional lot of popular names for all Australia, which shall be taught in our schools and generally used, but even then we shall always require the ultimate appeal of the scientific appellation. Thus, in order to mark off our common Heath from closely allied heaths, we call it *Epacris impressa*, and if we wish to be quite clear that we refer to the plant originally described by that name, we write after it the name of the person who described it, in this instance, Labillardiere. We write it down as *Epacris impressa*, Lab. The first name is that of the genus to which the plant belongs, and is formed on a Greek model. The second name marks the species, and is of Latin form. These names are better if they denote some feature of the genus and species respectively. Unfortunately, this is not always the case, so they should generally be treated



PRICKLY RICHEA.
(*Richea scoparia*, J.D.H.)

[See p. 16

as proper names, marking the plant, but bearing no other significance. In the present case the second name, *impressa*, is of use. The corolla of this plant has five small impressions in the lower part, which marks it off clearly from all its near relations.

When we wish to refer to one kind of plant we call it a species; thus *Epacris impressa* is the name of a species, and is distinct at least in our minds from the common Rocket, *Epacris lanuginosa*. We commonly speak of a species as if it was one clearly marked or rigid form. In that we are wrong; there is no such circumscribed species. We can seize on one form, make it the type, and compare others to it, and if they do not depart much from it we say they belong to that species; but, after all, the species is only a group of forms which we, for the sake of convenience, treat as one. If we raise fifty young from the seed of a plant, no two are exactly alike; some may be very similar, others not. If we raise more from the dissimilar ones, we may soon produce forms very unlike the original. This change may occur in nature, and may in time become a fixed character; then it is only a matter of opinion whether the new form shall be considered a distinct species. The name species is purely arbitrary; it is convenient and necessary, but has no absolute significance in nature. The natural consequence is that botanists vary in what they call species. Here we are calling several forms one species, under the name *Epacris impressa*. The most able local botanist we have had, Ronald Gunn, made three species of it. Next generation a botanist may break it up into a dozen. This is disheartening to the beginner, who likes simplicity. He must blame nature, not the botanist.

When we find a group of species, the Wattles for instance, which show such a great likeness in essential features that we conclude they are close or recent offshoots from one type, we form another semi-natural group, which we call a genus. In the same way we group genera into families, and families into Orders. This brings all known flowering plants into about forty-two large more or less natural groups. These again are clearly divisible into two classes, the Monocotyls, containing the Grasses, Rushes, Lilies, Orchids, and such, and the Dicotyls, which contains the rest. These two classes are very distinct, and no proof has yet been brought forward that one is descended from the other.



HOVEA LONGIFOLIA. R. Br.

[See p. 20

Chapter IV.

PEAFLOWERS.

This is a large and very natural family. In order to illustrate its features we will examine one of our commonest bush flowers, Prickly Beauty.

This flower is fortunate in having an original popular name all to itself. For once, the people who gave names in days that were earlier did not attach to this plant an old and quite inappropriate name belonging to a shrub at the other side of the world. Most people at all familiar with the bush know Prickly Beauty, know it as a small shrub, with small sharply-pointed leaves that are concave on the upper surface. The flowers are few in the upper axils, and are of the form so familiar to us all in the Pea-flower. For purposes of general information, any other of our native Peaflowers will do to illustrate, but as this family is very large and the members differ only on small differences, it has been thought necessary to divide them up into genera, marked very often by trivial differences, so in describing this flower it will be advisable to take note of these arbitrary marks, wherefore it is best to follow this article with a specimen of the true Beauty.

As already stated, the flowers are few, and are placed singly in some of the leaf axils. They are not massed together at the ends of the branches as they are in many closely-allied shrubs. Each flower is on a distinct stalk. The calyx is made up of five sepals, but, unlike those of the Heath family, which are all separate from one another, here they are more or less united, so that the calyx is in the form of a broad tube, with five short lobes, and of these the two upper lobes are rather longer and more united than the lower three. Though apparently trivial, this is an important matter to whoever wishes to understand the classification of Peaflowers.

The corolla is made up of five petals, which are very unequal in size. The upper one has a very narrow base, above which it broadly expands into a conspicuous disc, slightly notched on the upper margin; it is placed outside the other petals, and encloses them in the bud. It has received the name of the standard. Next are two small oblong petals, placed one on each side; they are called the wings. The next pair are placed below, and are more



CLIMBING EPACRIS.
(*Prionotes cerinthoides*, R. Br.)

[See p. 20

or less coherent along the lower margin, forming a boatlike space on their upper surface, in which lie the essential organs of the flower. These two lower petals are together called the keel. The petals are all yellow, more or less marked with purple-brown. This arrangement of the corolla gives to Peaflowers their peculiar appearance, which to some vivid imagination has recalled the idea of a butterfly. As the scientific name of a genus of typical butterflies is *Papilio*, so botanists commonly call Peaflowers papilionaceous, and give to the family the name of Papilionaceæ.

A thing that should be noted is that the petals are not attached, as in Heath, to the top of the flower-stalk, but to the inner surface of the calyx tube. The insertion is so close down that this is not very noticeable, but it is the commencement of the removal of the corolla from the top of the stalk that develops further in Roses, Saxifrage, and many other families, to culminate in the Myrtles and Umbellifers. It is a matter of first importance in the sorting together of different families of flowers.

The stamens are ten in number. Each consists of a slender filament and a two-chambered anther. They are inserted in a calyx tube close to the base of the petals. The stamens are all free from one another. This is a condition that marks a section of shrubby Peaflowers, far more common in the Southern than in the Northern Hemisphere. Other sections which are also represented in Australia have the filaments united for part of their length in a tube, which may be entire or open above, or the nine lower filaments are united, but the upper one free.

The pistil of a Peaflower is very simple. It consists of a single carpel, which develops few or more ovules. The pistil in the flowering stage is always slender. It lies in the centre of the stamens, in the cavity of the keel. From the end of the ovarian cavity it is prolonged in a slender style, which bends upwards towards the tip, so that the small terminal stigma comes to lie amongst the anthers at the end of the keel.

Comparison with other plants and study of malformations has led to the conclusion that a carpel is a modified leaf, and usually bears the ovules on its margin. This is easy to examine in a Peaflower, as no complication is introduced by the blending of many carpels. The carpel is a leaf which in our flower is bent together lengthwise, so that the margins meet together and the ovules hang down into the ovarian chamber from above.

The fruit of a Peaflower is a legume, a form of fruit so well known to us in the Pea or Bean. On maturity, it splits along one or both margins to expose the seeds. The shape of the pod and the number of the seeds normally present are of interest, and are used to help to arrange the huge family of Peaflowers in groups. In Prickly Beauty the pod is very small, nearly round, splits principally along the upper margin, and contains only two seeds.

Those who wish may note two details to assist in identifying the genus to which Prickly Beauty belongs, namely, *Pultenaea*. In many plants, at the base of the stalk of the leaf there is a pair of processes, arranged one on each side. They may be in form anything from large and leaflike to little spines or tubercles. They are called stipules. In the genus to which Prickly Beauty belongs stipules are generally, but not always, present, but when they are they are always small, brown, spiny bodies, and in this form they appear here. But a more constant mark of a *Pultenaea* is that there are two little stipule-like bracts, called bracteoles, placed upon the calyx.

Peaflowers appear to be especially constructed to make use of the visits of large insects, such as bees, for purposes of cross-fertilisation. In the centre of the flower, around the base of the pistil, a sugary fluid is secreted. A bee in search of this alights on the keel, and in struggling to reach this nectar it depresses the point of the keel; the anthers and stigma immediately jump up, with the result that the pollen is dusted on the under part of its body. When the bee visits another flower the process recurs, with the result that the stigma is dusted with the pollen it brought with it. It will be readily perceived there is nothing in this to prevent the pollen of its own flower getting on the stigma. This really occurs, and effects fertilisation if no foreign pollen is present. Here comes in one of the provisions to prevent self-fertilisation. Its own pollen acts very slowly, and if not given too long a start the much more rapid developing foreign pollen overtakes it, and fertilises the ovules. This selection of one pollen over another is called prepotency.

There is a small family, to which our Love creeper belongs, whose flowers at first sight resemble Peaflowers. But it is only a general resemblance; they are really not at all alike and the fruit is not a legume. They will be dealt with later.

It would be a natural conclusion that plants related to one another should have similar fruits, and conversely that

similar fruits in two plants should indicate a close relationship, but this does not appear to be the case. Fruits of like structure do not indicate common descent. They are specialised developments to insure the effective dispersal of the seed; consequently any advantageous change in form of any member of a family may give it an advantage which will enable it to reproduce its kind more successfully than its less fortunate relatives. The same thing applies to leaves. Consequently very different leaves may be found in one family and similar leaves may be found in very different ones. Particular forms of fruit or leaves must not therefore be taken to mean relationship. The leaf of the Plane is very like a Maple. The fruit of the Blue Climbing Berry, which is closely allied to *Pittosporum*, is similarly constructed to the fruit of the Blue Berry and Turquoise Berry, which are both Lilies. But although this similarity of fruit and leaf is not to be relied upon as indicating relationship, yet we find in some instances a peculiar form of leaf or fruit may be common to one family; further, it may be confined to the members of one family. This fact has led enterprising geologists to discover in certain leaf-impressions the presence of Oaks, Willows, Elms, and many other families in rock strata. It is certain that some of these conclusions are erroneous.

This family, as already said, is a very large one. Some are small herbs; others tall trees. Some grow erect; others grow flat on the ground. Some have a copious foliage; others no leaves at all. Yet all conform to the same type of flower and fruit.

We have no room to draw attention to more than a few forms. In sandy spots, especially near the sea, the Running Postman is often found. The branches are slender and lie flat on the ground, bearing leaves with three flat broad leaflets. The flowers are rather large and bright crimson, rarely white, forming conspicuous objects. The lower nine stamens are united for some distance, and the upper one free. The pod is rather long, cylindrical, and many-seeded.

Native Gorse is an erect, much-branched shrub. Its leaves are very sharp, but vary greatly in breadth. Sometimes they are very narrow, like spines; at others they are broad, but always sharply pointed. The flowers are small, yellow, and in axillary bunches. The pod is small, flat, and triangular. To the same genus as this belongs Bitterleaf, or, as it is often called, Native Hop. It differs in the leaves being broad, blunt, with conspicuous netted



PRICKLY BEAUTY.
(*Pultenaea juniperina*, Lab.)

[See p. 25

veins and very bitter taste. The name Native Hop is bad, not only because it is no relation to the Hop, but because the name is also given to a small tree whose fruits have a fanciful resemblance to those of Hop.

Clovertree is a tall shrub, with trifoliate, cloverlike leaves and pale-yellow flowers in loose clusters.

Native Indigo is a true Indigo. It has leaves with numerous flat leaflets, long slender branches, and clusters of pretty dark-pink flowers.

In Tasmania we have a few Peaflowers whose leaves are reduced to little or nothing. The commonest is a wiry little *Sphaerolobium*, seldom more than a foot high, with numerous small yellow flowers arranged singly along the branches. It is found in grassy places. Another leafless plant found on poor mudstone hills is *Bossiaea riparia*. It is a little shrub, and to make up for the absence of leaves the branches are flat and broad. Unfortunately, these last two have no popular names.

Plants are not passive objects responding indifferently to their surroundings. They are endowed with life just as well as animals. If they differ it is only in detail, not in principle. Animals and plants are made separate kingdoms for our convenience, and not from any clear distinction. They are but one series of beings, differing greatly when the extremes are considered, but absolutely continuous where they meet.

Plants do not see nor hear, nor is there any reason to think they feel in the sense that they are conscious of a disturbance. Nor are lower animals possessed of these powers. But plants have the ordinary functions of living beings, and also special senses of great acuteness. Because we do not find in them the senses we possess, we do not at first sight credit them with any. Yet plants are sensitive to gravity, light, heat, and contact, according to their kind, and that to a degree of extreme delicacy.

Every plant has a constitution of its own, an individuality. It is capable of responding to outside influences, but only along certain restricted lines. It can only respond as far as the peculiar composition of its substance will permit. This is generally called inherited disposition. But a being cannot inherit a history. It can only receive substance, and were its substance the exact counterpart of that of perfectly similar parents, and its surroundings were exactly the same, then the young would be just a repetition. But the factors are never the same therefore we have infinity of variation. An ovule is not a new

thing; it is simply the constricting off of a particle of substance from the parent. It becomes complicated by the blending with it of the contents of a pollen grain derived generally from a slightly different plant. It then grows into an individual, but though independent, it is simply a continuation of the life of the parents with their functions and possibilities. Therefore, when we speak of inherited qualities, we simply mean the substance of which the new plant is formed was not changed in character in being separated from its ancestor. We should consider it extraordinary if it was.

Chapter V.

THE MIMOSA FAMILY.

This family is closely related to the Peaflowers, so much so that the two are commonly linked together. The fruit and seed are alike, but the flowers differ. In Tasmania we have many species, but they all belong to one genus, *Acacia*, locally called Wattle, or, in some instances, *Mimosa*. This latter name should not be used, as we have no true *Mimosas*.

Acacia is the largest genus of Australian plants. They are all shrubs or trees; something like three hundred and fifty species are described. Out of all these only one species extends beyond the Commonwealth. Other forms occur in Asia and Africa, but are nowhere as abundant as they are with us.

In Tasmania we have seventeen species, and for the sake of convenience we can divide them into three groups according to the shape of their leaves. One group has divided leaves, a second has flat, blunt leaves, while in the third they are simple and prickly. Of the first we have three forms: Silver Wattle, whose ultimate leaflets are very narrow and clothed with delicate hairs, giving a bluish tinge to the foliage—it flowers in the spring; Black Wattle, in which the leaflets are the same shape, but nearly hairless and dark-green—it flowers at midsummer; and River or Green Wattle, whose leaflets are broad, and whose flowers mature in the autumn. Of the broad, flat-leaved forms, Blackwood, Native Willow, and False Boobyalla are the commonest. There are several prickly-leaved forms, and they are mostly known by the one name, Prickly *Mimosa*. All these forms, when young, have divided leaves, and in response to injury at least Blackwood may throw out such at any period of its life. The simple forms are produced by broadening of the leaf-stalk and suppression of the leaflets. This is an adaptation to make them better suited for our very sunny climate. This reduction of leaf surface and thickening of substance, which may, however, be brought about in a variety of ways, is very common in sunny countries, especially where rainfall is not correspondingly heavy. It is very noticeable in Australia in all sorts of families.

The flowers of *Acacia*, from their small size and the habit in most species of being massed together in heads, renders them somewhat difficult to examine, and impossible without a lens. Each of the fluffy spheres we see consists of many flowers. We can detect this better before they have opened. The calyx is minute, and consists of four or five free or slightly united sepals. The corolla is scarcely larger; the petals are the same number, all equal and seldom united. The stamens are very numerous. Their filaments are very long, slender, and free, tipped with minute anthers. The solitary carpel, shaped just as it is in Peaflowers, is very small, yet contains several ovules. It is prolonged into a very slender style, which is much longer than the stamens, and appears as a delicate bristle protruding amongst them; it is tipped by a minute stigma. The fruit is a legume, that is, a pea-pod, which varies in shape according to the species.

Acacias generally bear abundant flowers, but few of them produce fruit. The copious formation of pollen and its close contiguity to the stigma must ensure some of it being received in every flower. This would lead to the supposition that crossing is imperative. A considerable amount of honey is formed, and bees much frequent them; probably, also, small birds assist.

The seeds are of the shape of small flat beans. Their coat is dense and almost impervious to water. This enables them to retain their vitality for a long period. But no credence must be given to the statements often made that seeds may retain their vitality for many centuries. This matter has been well thrashed out, and it is fairly certain that very few, if any, can retain the power of germination up to one hundred years. This will be further considered in another chapter.

Of our seventeen Acacias, most are commonly to be met in the bush. The three with divided leaves have a very similar floral arrangement, namely, in little spheres each made up of many flowers, and the spheres are numerous on much-branched stalks which arise from the axils of the leaves.

In the broad-leaved forms we have four modifications. In the pretty little Myrtle-leaved *Acacia*, which is usually only 1 or 2 feet high, the flowers are rather larger than is the case with our other forms, and are placed singly or few together on the branched flower-stalks. This plant is therefore useful to the beginner who wishes to examine these flowers. In Native Willow and a closely allied form

the flowers are in spheres, but each of these is on a stalk of its own, though two or three may occupy the same axil. In Sweet-scented Acacia and Blackwood the flowers are in spheres on much-divided stalks, very much as in the divided leaved plants. The first is a shrub with many long, erect, angled branches with long narrow leaves marked by a central rib; while Blackwood is a tree with broad leaves that have not a central predominating rib. False Boobyalla is a tree or shrub of the coast, with leaves very like Blackwood, but very different arrangement of the flowers. These are numerous and formed in long club-like masses. The name of this plant is bad, as it is not only no relation to, but is not at all like, the true Boobyalla, which is a *Myoporum*. The only similarity is that they both thrive on the coast.

Of the spiney-leaved forms, unfortunately called Mimosas, Spreading Mimosa has flowers arranged as in Native Willow; Prickly Mimosa as in False Boobyalla; Drooping Mimosa has long slender drooping branches with the flowers, though many, not massed, but arranged singly along the flower-stalks.

People who have lived all their life in Australia, and have from their childhood grown up amongst shrubs and trees with restricted foliage, consider such a condition a matter of course. But anyone arriving from such a humid climate as England is greatly struck with the absence of dense leafage, and consequently effective shade, also the sombre tints of the forests. If you are caught in a shower in the Old Country you stand under a tree till the rain has passed; but it would be a very insignificant fall that a Gumtree or Wattle would protect you from; also, in intensely hot weather, it would be nearly as easy to get sunstroke under a Eucalypt as it would in the open. In quiet damp valleys and gullies foliage may abound, but the general character of our Australian plants is that of reduced leaves of thick texture, and this has an evident meaning. The green surface of a plant is a matter of the utmost importance. It is this surface that enables it to perform the marvellous work characteristic of plant life, namely, of constructing food from the simple substances present in the atmosphere. It is to this green layer that practically the whole of the plants and animals upon the earth's surface are dependent for their living. It may therefore be recognised that the larger the green surface a plant can expose to light the greater quantity of food will it be able to construct. The development of leaves



WEeping WATTLE.
(*Acacia riceana*, Hensl.)

[See p. 32

is the common way in which a plant enlarges the surface; but there are other factors to be considered. Plain surface means rapid evaporation, and this loss of water has to be made up by correspondingly rapid absorption by the roots. If the evaporation from the leaves is in excess of what the roots are able to absorb and pass up through the stem, wilting and cessation of function will take place. Not only that, but it is found that too rapid a passage of water is itself injurious. Also the green tissue of a leaf is a very delicate organ that will not bear too free an exposure to intense sunlight. Therefore a plant with a copious delicate foliage is ill-suited for growth in a very sunny, dry district. Conversely, we should expect to find in such a district that the plants consist of forms with reduced means of evaporation and leaves modified to protect their delicate tissue. Australia as a whole is far too sunny and of too dry an atmosphere to support such a vegetation as would thrive in Europe. We therefore have a preponderance of plants well suited to our conditions. Leafless plants are common. Plants whose leaves are much reduced in surface and of thick consistency are much more common, while our Eucalypts compromise by hanging their leaves up and down to escape the full force of the sun's rays. The Acacias, whose remote ancestors without doubt had extensive leaf surface, have adapted themselves to Australian conditions. Some have no leaves: in others these organs are much reduced; and in all structural changes have taken place to reduce evaporation and the penetration of too intense light.

The three great families typical of the Australian bush, the Myrtles, Proteas, and Legumes, are conspicuous in the structure of their leaves. If these organs are not reduced greatly in surface their thick, leathery consistency has the same effect. This gives to our landscape the peculiar sombre appearance so much in contrast to our sunny skies.

Chapter VI.

THE ROSE FAMILY.

This family is a large and important one, not only from the interest it bears for the student, but on account of the beautiful flowers and useful fruits produced by some of its members. Its natural home is the Northern Hemisphere, where it has developed numerous forms of great variety. In Australia it is very poorly represented with native forms, but in addition to these we have amongst our wild flowers some introduced plants that have made themselves quite at home. In this chapter it will be well to examine some of our cultivated plants as well.

The Rose family is one of the most difficult for the young student to master. It contains shrubs and herbs, but none large enough to be called trees. The habit of the plants, the details of their flowers, and structure of the fruits are so various that there appears to be no one feature we can seize hold of as a mark. Yet the family is natural; that is, there appears an evident likeness in character amongst its members by which we recognise their distinction from all other families. This is one of the great troubles in endeavouring to learn the classification of flowering plants—we have to depend so much on judgment and so little on definition.

There are three principal features we may note as common. The carpels are in nearly every case one-seeded and free from one another. The stamens are numerous, and together with the five free petals are inserted on a cup-like expansion of the thalamus, and not close under the pistil, as in Buttercup. This expansion is small in Plum, but very large in Rose. We shall note its extraordinary development in the fruit of Apple.

We have no native Rose; those flowers which look very rose-like we shall find belong to the Saxifrage and adjoining groups. But Sweet Briar is quite as wild as our farmers care for. We will examine the structure of its flower. The base of the flower is a round or oblong hollow body. In older works it was the custom to call this and all similar developments in other flowers the calyx tube. In the present day we consider it is not part of the calyx, but an expansion of the flower-stalk, and is called the floral tube. In some few instances there may be doubt on this

point, but as a rule when there is a tubular or cup-like expansion it is wise to consider the calyx to commence at the spot where the petals and stamens are inserted. Well, a Rose has a very large round or oblong floral tube, from the top of which come off first a row of five sepals, then one of five petals, and close above these a circle of many stamens. In cultivated Roses the petals are greatly increased in number, and this generally occurs by stamens being converted into petals. This change in appearance is not as marvellous as it seems, as all these organs, except the spore-bearing sacks sometimes found on them, as the anthers on the stamens and ovules on the carpels, are simply modified leaves, and may with little difficulty revert to a more leafy condition. We often meet with flowers in which the inner organs revert to the condition of ordinary green leaves, and then the centre generally grows up into a leafy shoot. If you cut a Rose open you will find inside numerous seed-like bodies. Each of these is a carpel, and contains one ovule, which will become the true seed. The carpels each have a long slender style with a little round stigma at the end. These stigmas may be seen protruding in the centre of the flower. When fruit is formed the floral tube becomes fleshy, and red to black in colour. The carpels do not burst to allow the single seeds to escape, but harden and function as a seed-coat. This condition of fruit is useful to the plant in furthering the distribution of its seed. Browsing animals eat these fruits, called Hips, and the seed-containing bodies being quite indigestible, provided they escape being crushed in mastication, are accordingly dispersed.

Cherry, Apricot, Almond, and such have flowers of a much simpler development. The floral tube is small and cup-like, but the sepals, petals, and stamens, like Rose, are placed in succession on its edge. The pistil consists of a single carpel placed in the centre of the flower containing normally a single ovule. In developing into fruit the outer part of the flower withers, and till it falls off remains below, while the fruit develops into a fleshy globe containing a single stone. The wall of the stone as well as the flesh is developed from the wall of the carpel. The kernel is the seed. In Almond the outer coat is green and only slightly succulent.

In Apple and Pear there is a different modification of the Rose type. The floral tube is well developed, but not as much so as in Rose. The sepals, petals, and stamens are similarly placed. The pistil consists of a circle of about

five carpels, whose bases are more or less sunk in the substance of the tube. When fruit forms the tube grows enormously, carrying up the withered sepals on its apex, and burying the carpels in its centre. If you cut an apple through, the outer part of its flesh was formed from the tube, and the inner portion and the hard part of the core from the carpels, in each of which are one or two pips or seeds.

We have two native Raspberries, and a very much run wild Bramble or Blackberry. They develop another form of fruit. The floral tube is small, but the centre of the thalamus grows into a cone, upon which are placed few or many carpels. The fruit is formed by each carpel growing into a small fleshy globe with a hard centre containing a seed. The cone of the thalamus grows to accommodate the enlarged carpels.

The Strawberry is a further modification of this. The central portion of the thalamus enlarges into a great fleshy fruit carrying the little dry carpels on its surface.

It is unusual for a family of plants to have so much variation in the structure of its fruit as we find in the Rose family, but we must be always prepared to meet great diversity; not only that, but we must not be surprised if we find such a fruit as a berry in many different families. We find the immediate organs of reproduction are altered only slightly in long periods of time. Their position on the plant may be subject to modification, but their characters are ever the same. There is little difference in the pollen sacks of the anthers and the ovum sacks of the ovules throughout the whole range of flowering plants. And they do not materially differ from the same organs found in lower plants. Their function is definite and their character fixed. With fruits it is a very different matter. Their function is to protect and disseminate the seeds in the most effective manner. We find some fruits so hardened that neither animals nor fire can damage the seed; others open elastically, and cast the seed far away; others again are winged, to ensure being blown to new places; while yet others tempt animals to eat them and cast the undigested seed in new situations. Any advantageous change is of great benefit, as it enables a plant to propagate more effectively than its fellows. Wherefore if a plant develops a small but effective improvement, and such sudden developments take place oftener than is generally supposed, it will have an advantage which will enable it to spread more effectively than the others of its

kind, which it will soon overwhelm in the struggle for existence. Such a sudden change, if of conspicuous advantage, will therefore become fixed; if not of so much importance, it will generally be obliterated by being bred out by the average.

All plants vary in at least minute details from their ancestors, but cross-fertilisation tends to keep them about the mean. Fruits of an advantageous type are of such great importance that we can readily understand their assuming many forms within the scope of one family. And as their possibilities are limited, it is also easy to understand how the same type may be developed in many parts of the vegetable kingdom. These sudden changes in organisms are responsible for the enormous variety of plants and animals in cultivation. A man does not cause the variation, though he may assist; but when a difference suddenly presents itself he enables it to be maintained and continued by preventing it being bred out by the average or common form.

It is rather interesting to note that throughout the Roses the colour blue appears absent from its flowers. You find red, yellow, white, alone or variously mingled, but never blue. You find a somewhat similar condition in our native Heath. While in Asters the conspicuous flowers may be any shade of blue, red, white, but never yellow. The use of colour is for the purpose of attracting insects, and blue and red colours appear to attract principally in day time; yellow and white are more conspicuous in the dull light of evening and night. There is one class of naturalists who love to see an accurate purpose in every detail of nature. When this is carried to excess it tends first to deceive, and then to disappoint the young student, and neither of these conditions are to his benefit. There are in nature innumerable marvellous adaptations, but it is going altogether too far to claim that every modification we find in a plant has some adaptive advantage. On the contrary, probably in every plant there are many minor structures and qualities that are there as purely negative conditions. They are of no distinct use, nor would their suppression materially benefit the plant. We should be more correct in saying that though a plant must be adapted to its surroundings, yet none is exactly adapted. If it were so, no variation could be to its advantage, and we know variation is the rule, not the exception. Heath and Rose set seed equally well whatever tint their petals may be.

Another class of conditions which are mostly negative, though often of use, are the hairy structures on the skins of plants. Few plants are perfectly hairless. In Roses we find a peculiar development of the hairs in prickles. These are of obvious advantage, sometimes as protective organs sometimes as in the case of the Bramble, also to help to support it amongst undergrowth. At other times a copious hairiness protects a surface from being wetted, from frost, or from rapid evaporation. But the slight hairiness so commonly met with has no useful purpose. It sometimes means the survival of a previous more hirsute condition; at others a fortuitous development that may become of use.

Chapter VII.

THE MYRTLE FAMILY.

The Myrtles form by far the most conspicuous feature of Tasmanian woodlands. Eucalypts, Bottlebrushes, and Teatrees are the commonest genera, while the pretty little Baeckias and Native Broom assist in adding interest to our heaths. These, with a few more, are the Tasmanian representatives of the family. We call our Beech by the name Myrtle; this is wrong, and should be suppressed. Beech is quite as easy, and has the advantage of being correct.

The name is given to the family because the European Myrtle is a typical member of it. Like the Roses, we have here many forms of fruit. In Myrtle and some Australian forms it is fleshy, like a berry, but our plants have mostly dry capsules, though Native Broom and our rare Thryptomene have little one-seeded nuts. Besides the structure of the flower, there is one common feature in all our forms—little glands of oil are formed in the leaves. These can be seen by holding a leaf up to the light, when they appear as pellucid dots, or crushing them in the hand, when the odour of the oil can be readily perceived. This formation of oil dots is not confined here; we find it also in the Rue family, to which belong Boronia, Native Fuchsia, and Stinkwood, but it is uncommon elsewhere. It is worthy of notice that very often amongst plants when an unusual feature appears, as, for instance, this formation of oil drops, or the possession of some poisonous principle, it is common to the whole group to which the plant belongs, though in varying degree. The leaves of all the members of this large family are of simple outline; that is, they are never broken up into lobes or leaflets.

This family is well defined by general features, but it differs from the Roses in its flowers. The carpels are blended together, so that the pistil appears as one body, and in the floral tube is united much more consistently to the pistil. This appears a small matter, but it is another step in advance towards a higher type, where the tube completely envelopes the carpels so as to bring the ovary below the flower.

A Teatree may be taken as a type. It has pretty little flowers, like miniature single roses. They are placed singly

in the axils, or at the ends of short branches, and have very short stalks. The floral tube is well developed, and closely blended with the pistil for some distance, in many cases even to the top of the ovary. This union is so close that tube and ovarian wall appear like one structure. Above there is always a free portion to the tube. From the end of the tube arise five small triangular sepals, and closely above and alternating with them five round, spreading, white or pink petals. The stamens arise close above the petals, and are numerous. As the condition of the stamens is largely made use of to separate the closely-allied genera, we must pay some attention to them. They are all free from one another, arranged in a single row, and are shorter than the petals. The filaments are slender, and attached by a point to the back of the small oblong anthers. There are usually five carpels, but in one Teatree there are ten. The ovarian portions of these carpels are arranged in a circle, and where their walls touch they are so blended that there appears only a simple division between the cavities and at least in their lower portions they are intimately united with the floral tube. From the centre above and from a slight depression arises a slender, simple, erect style, terminated by a little head, which is the stigma. At the inner angle of each ovarian cavity there is a little cushion of tissue, upon which are developed numerous minute ovules. Any cushion or place where ovules grow is called the placenta.

In developing into fruit the condition does not much change. It only becomes somewhat larger and harder, the sepals in most cases remaining on the top of the rim. The top of the fruit may be flat or convex, sometimes in the same species, and it splits in a radiate manner along the top of each ovary to allow the seeds to escape. These seeds are small and slender, and the genus of Teatrees has been named from this fact. The name is *Leptospermum*, which means slender-seeded. The Teatrees are not all well marked; some forms run very much into one another. The Woolly Teatree is the commonest. It has a flat blunt leaves, and the green portions of the flower are more or less covered with delicate hairs. It prefers damp situations. Manuka or Prickly Teatree is also common, but it prefers open places and hillsides. The leaves have a sharp termination, and the fruit is very convex, a large part of it protruding above the tube. There is one thing worth noticing in it, that flowers that bear well-developed stamens often have stunted and barren ovaries. This ten-

dency to separate the functions of stamens and pistil is much more pronounced in some other flowers, as we shall see when we refer to this later on. A third rather common form is the Slender Teatree, found in damp sandy heaths. The leaves are regularly oval. The fruit is small for the genus and quite flat-topped; also, it becomes rather fleshy at maturity.

We have five different shrubs, commonly known as Bottlebrushes. They owe their name to the peculiar arrangement of their flowers. These are formed many at a time. They are without stalks, and arranged close together, so as to form a dense mass of flowers closely massed towards the ends of the branches. The sepals and petals are small, but the stamens are long and stand straight out, so that when in bloom the whole has very much the appearance of a bottle-cleaner. These five plants belong to two genera, four in one and one in the other. Having no very distinct popular names, it will be necessary to use their botanical ones. The first is *Melaleuca*; the second, *Callistemon*. *Melaleuca* means black-white, in allusion to the shades of bark seen on a shrub by an early observer. *Callistemon* means beautiful stamens, and as in many Australian species these are a brilliant red, we can feel more sympathy with this name than we can with the other. The two genera are very close, and run into one another. They differ in general appearance, but the principal contrast is that in *Melaleuca* the stamens are arranged in five definite bundles, with their filaments more or less united below. In *Callistemon* they are variously arranged, according to the species, but never so clearly collected into five bundles. In our *Melaleucas* the union of the stamens is very short, so that the distinction is less pronounced than it is in most mainland forms. In both genera the anther cells are parallel, and attached to the filament in the middle of its back. There are other Australian genera that differ mainly in another form of anther. In all our Bottlebrushes the base of the flower is buried in the bark, and the fruit persists during life so that the old capsules may be seen still on the bark, marking each year's flowering. The floral tube is united to the ovary, and extends beyond it; the five small sepals are persistent; the petals are small, and much exceeded by the numerous stamens. The other details of the flower do not differ materially from the condition found in Teatree.



PURPLE BOTTLEBRUSH.

(*Melaleuca squamea*, Lab.)

[See p. 42

Yellow Bottlebrush is a rigid shrub found in wet places. The leaves are short, broad, and arranged in opposite pairs, so that each pair is placed at right angles to those above and below it. The flowers are always yellow. Purple Bottlebrush is a shrub of damp heathy places. The flowers may be either purplish or yellow. The leaves are less broad, and alternately arranged. Dwarf Bottlebrush is a pretty little shrub of heathy country. The small flowers are purplish, the leaves only about one line long, and arranged in opposite pairs. Swamp Bottlebrush also known as Swamp Teatree, only occurs in the north. It grows into a small tree, has yellow flowers, and small linear alternate leaves. Our only Callistemon is a shrub of the hills. It bears copious yellow flowers, and flat leaves fully an inch long.

We have only two or three *Bæckias*, and they have no popular names. May not the botanical one be popularised? *Bæckia* is just as easy and pretty as any other is likely to be, and it certainly will not lead to confusion. The common one is a pretty little wiry shrub, that raises itself amongst undergrowth in heaths. The leaves are narrow, and about a quarter of an inch long. The flowers are on rather long stalks, but are shaped otherwise very much as they are in Teatree, only the stamens do not exceed ten, and there are only one or two seeds in each cell of the capsule. The petals are pinkish-white.

Native Broom is unfortunately named, as it is not a relation to, nor is it a bit like, the true Broom. It is a small shrub of heathy land. The flower is not like the Myrtles we have examined, and at once distinguish it. The floral tube is long and slender: it is just like a stalk, but it is intimately blended with a contained ovary, which bears but one ovule. Above the ovary it is continued in a slender stalk-like condition for some distance, when it suddenly produces five diverging sepals. These are connected together at the base by a thin membrane, but the points are elongated into spreading slender bristles. The petals are five, and stamens many, but neither are conspicuous.

The Myrtles are chiefly plants of warm, sunny places. Though a few of them can withstand the intense cold of a high altitude, none of them extend to a high altitude. They are well adapted to dry conditions. The leaf surface is small; its skin is thick, and covered by an impervious cuticle often coated with wax. This condition is eminently suited to reduce evaporation.

Plants respond to their surroundings. Individual plants may be profoundly influenced, so may the race, yet there appears to be no connection between this individual change and the race change. In other words, the character of a plant may, by peculiar conditions of feeding or exposure, be much modified, but it has no power of transmitting this modification to its offspring. The seed may be poor or well filled out, according as the plant has been ill or well fed, and a weak or robust plant may result, but no other condition is transmitted. Thus many plants which, if grown in ordinary soil have thin leaves, will, if the soil contains much salt, become thick and fleshy, but will immediately again produce thin-leaved young if their seed is planted on normal soil. A fern growing on our mountain tops is copiously hairy, but if it is brought down to a low elevation the new leaves gradually lose that condition. The seed-producing parts of a plant are the oldest and best fixed of its organs, and they appear to do their work along fixed lines without transmitting any personally acquired character. This is at variance with popular ideas, but is the result of overwhelming evidence in both animal and vegetable kingdom. The persistent change in habit is due to other and racial causes, and will be dealt with in a subsequent chapter. Therefore, we must look on the adaptation of Myrtles to Australian conditions to be other than the response of individuals.

Chapter VIII.

EUCALYPTS.

The most striking feature in an Australian landscape is the Gumtree. It is the typical tree of Australia, and makes up the bulk of our forests. There are about a hundred and fifty species, comprising all sizes, from shrubs to some of the loftiest trees in the world. They are equally variable in distribution, occurring from Tasmania to the Northern Territory, from the extreme east to the farthest west, and from sea-level to near the top of mountains. With all this wide range it is singular that only two or three species are found outside Australia, and they only extend to the Indian Archipelago. Although Gums have such a wide range, most are very sensitive to environment. Different altitudes support different species. The tree of a 2000-foot situation will not, as a rule, be found much above or below it. Hardly a Gum native of Tasmania is found as far north as Sydney, and equally few are common to both East and West Australia. They constitute the genus *Eucalyptus*, which again belongs to the Myrtle family. The name is composed of two roots: *eu* signifies complete or typical; and *calyptus*, a hood. The name is very appropriate, as it marks the peculiar cap that falls off when the flower expands. The distribution, varied forms, and relation to its immediate allies lead us to conclude that *Eucalyptus* is a very modern genus; that is, it is of comparatively recent development. Of course, when we speak of recent in geology or botany we mean something more than a few thousand years. Such a period, though much to man, is as nothing when we are dealing with changes of the earth's surface or the evolution of animal or plant life.

In order to understand more of a Gumtree, let us take what we may term an intermediate form, and in studying that compare it with other types. We will examine Mannagum, also called White-gum, or, botanically, *Eucalyptus viminalis*, Lab. The seed is a little dark object of irregular shape. It has a thick outer coat and a thin inner one, within which is a minute embryo plant with a miniature root and shoot, and two leaves which are closely wrapped round the other parts. Here the little being will lie for months, even years, nearly dormant, awaiting a favourable

opportunity to break into activity. If the favourable conditions do not occur within a period, varying with the species, but probably never extending beyond a few years, changes will have taken place within the embryo which will render it incapable of responding. It will be dead. But should the seed before it has lost vitality find itself on soil that is damp and not too cold, it will absorb moisture, the root will grow out of the coats down into the earth, and in about 10 days the leaves, with the shoot between them, will expand into the air. It should be noted that there are a pair of first, or seed, leaves; that they are equal and opposite to one another. This is a marked feature of the largest of the two divisions of flowering plants. Very soon the shoots grow up into a stem, and branches on its way to attain the dimensions of a tree. With this, as with most Eucalypts, the leaves of the younger parts are without stalks, and placed in opposite pairs; also, they are broader than the later ones, and do not hang down like them. Soon the branches grow the mature foliage, which is different; the leaves are narrow, stalked, alternately placed, and hang down, so as not to expose their surface at right angles to the sun. Some few Gums bear but little juvenile foliage; others retain it for life; while most, in response in injury, will revert to it. It is a common thing for a bunch of twigs with juvenile foliage to spring from a spot where the tree has been injured. Probably the ancestors of our Gums had opposite stalkless leaves, and the other state is an adaptation better suited to our conditions.

When a Gumtree is a few years old it commences to bear flowers. The size of these, their arrangement, and some other details vary with the species. The flowers of Mannagum are small; the solid part, that is, not taking the spread of the stamens into consideration, seldom equals three lines diameter; in some dwarf Peppermints they are still smaller; while in Blue-gum they approach an inch. They are arranged three together. A short stalk grows in the axil of a very young leaf. As the parts grow older three lesser stalks, each bearing a flower, appear on the end of this. In Blue-gum the flower is single, and closely placed in the axil; in Stringy-bark, Peppermint, Weeping-gum, and some others they are many, but all arising from the apex of the common flower-stalk. The bud is oblong, and it is easy to see it is divided horizontally about the centre into two different halves. On maturity the upper part falls off, and looks very like a mitre or hood, and the

enclosed stamens spread out in a circle. There do not appear to be sepals or petals. In Blue-gum and one or two more of our forms there is an outer hood, which is thrown off rather early. Now, comparison with closely-related genera, as, for instance, the Australian genus *Angophora*, leads to the conclusion that the outer hood is a much-altered calyx, and the inner one a modified corolla. Even if we could not directly detect the change, we should come to the same conclusion, for we find new structures seldom appear; what look like such are nearly always simply old structures changed in detail.

The stamens in *Eucalyptus* are of exceptional interest, as the forms of their anthers are of great use in sorting it into groups. They are numerous, free from one another, arranged in a circle upon the edge of the floral tube, and in the bud the long filaments are doubled, so that the anthers are tucked down towards the centre of the flower. In some West Australian species the stamens are straight from the first. When that is so the hood is like a long horn. The anthers are small, and in Tasmania assume two forms, which split our Gums into two natural sections. In Manna, Blue, Cider, and a few others the two halves of the anthers are arranged parallel to one another. In Stringy, Drooping, Peppermint, and Swamp the two halves touch above, but diverge below, assuming the shape of a kidney. In both cases each half opens by splitting down the centre. There is a third form not represented in Tasmania, where the anther opens by a pore instead of splitting. The pistil differs in no important detail from the form described in last chapter. The fruit is a capsule closely combined with the tube. In Manna-gum it protrudes, at least its valves do, giving the fruit a spherical appearance. In Cider, and more so in Urn Gum, it is deeply sunk, the tube much exceeding it.

Most Gums take time in maturing their flowers. From the first appearance of the bud to the bursting of the lid in Blue-gum generally takes two years; also, except those growing at a high altitude, they appear indifferent to the period of the season. Specimens of our lowland forms may be found in flower at any period of the year. When many of a species are in flower at the same time it is the result of a climatic condition, as dryness, that occurred some time before causing the change in the tree's condition that is responsible for the laying down of flowers. A Gum does not flower in a desultory manner; however long it takes for the blooms to come to maturity, they all burst out at

the same time. This, though a common habit amongst plants, is not universal. In cases where flowering is seasonal, the advantage is readily understood; but where, as in Gum, there appears an indifference, it can only be an advantage in that it enables the masses of their small flowers to be seen far off. Gums depend for cross-fertilisation principally on honey-feeding birds. It is an advantage to the birds that a succession should continue all through the year, and to both that a flowering tree may be picked out in the forest at a great distance.

These trees seem in no more hurry to disperse their seeds than they are in flowering. Seed is seldom ripe before a year, and generally longer; and when ripe they remain in the capsules sometimes for years, till those bodies are quite dead and dry. Gather old capsules that have been on the boughs for many seasons, and leave them to dry in paper; they will open their valves and let good fertile seed be shaken out. This condition of fruit and seed is of great value to trees growing in countries subject to fire. Any large Gum tree in our forests will be found to have on its branches thousands of capsules in a condition of maturity, but that have never opened to permit the seed to escape. If a fire occurs all the finer portions of the tree are killed, and the ground below is cleared of all undergrowth. The scorched capsules dry and open, and the seed falls on land quite prepared for it. This adaptation to fire conditions is very common in capsular Myrtles. Some Pines have the same habit, retaining seed in the cones for an indefinite period, until a fire sweeps the forest away, when the resistant, but scorched, cones deliver up their seed to build a forest anew.

A smooth-barked Eucalypt is readily killed by fire, that is, all that is above ground; but the roots in many instances respond by sending up suckers. In some cases the result of ringing trees is that the land is soon covered with a denser growth of Gum trees than it bore before. But all of them have not this resource, and can only produce shoots at the base of the dead stem, or not at all. The smooth condition of bark is produced by the tree shedding its outer bark as soon as dried. Gums do this at no stated period. If a tree is developing girth rapidly the bark is shed at short intervals; while the same species, growing under less favourable conditions, will shed it at longer intervals. Some trees, like Stringy-bark and Black Peppermint, have persistent, thick fibrous bark. This is a great protection against fire. It takes a very severe

scorch to kill it. It is common to see such a tree, after fire has killed all its smaller branches and burnt the bark black, break out into bunches of fresh vegetation all along the stem

If you cut a large piece of bark right down to the wood it can easily be torn away; then both the wood and bark will be covered with a colourless slimy substance. This appears in such a condition because its structure has been destroyed in pulling off the piece of bark. In its natural condition it consists of a few layers of very delicate cells lying between bark and wood. These cells are in a condition of active growth, constantly forming layers of bark cells or fibres on the outside and wood on the inner side. This layer of delicate cells, which is called the cambium, is responsible for forming the whole of the bark and wood. It may go on with its work all the year round, or may rest during the cold of the winter. Its activity may also be much reduced when lack of rain causes a dryness of soil. Trees growing in places where there is a marked but constant change of summer heat and winter cold, but never irregular periods of soil dryness, will form regular yearly rings of softer spring wood and denser autumn wood. This is very well marked in trees that shed their leaves in winter, in Pines, and in Gums growing at a considerable altitude. A Eucalypt placed at a low elevation grows all the year round, though it slows down somewhat in the winter; but if in summer its water-supply is reduced beyond its maximum requirement by a period of drought, development will be checked and the forming wood will be thin and hard, but will again be looser on return of moisture. This is why in Gum timber the rings are not always to be relied upon as indicating the age of the tree, and has given rise to the statement that our trees form two layers of wood per annum. The same tree may lay down one to three layers according to the condition of the season.

We have in Tasmania only one native, a Beech, of our westerly mountains, that sheds its leaves in winter; all the rest are evergreens. A tree growing at a high altitude, where there is inefficient or no sunlight during some months, will benefit by shedding its foliage; also, trees growing in districts subject to regular periods of great summer drought may benefit in the same way. But with us neither condition obtains. We can only think our deciduous Beech an immigrant from a more southern land, that has not the ability to change its character.

Chapter IX.

PURPLE HEATHER: ALSO BLUE LOVE.

The two plants that give their names to this chapter have no superficial resemblance but for all that they belong to closely-allied families. Purple Heather, popularly so called, is never purple, or has only a slight resemblance to that colour, and its claim to be called Heather is founded upon the slight fact that its size makes it look something like a Heath, and not that it is any relation. It is also called Purple Boronia, and for no better reason. This plant belongs to a small family of shrubs that appears to belong strictly to Australia, and even there does not extend to the warmer parts. It is rather close to the Pittosporum family; also to the Milkworts, a common English name applied to the group to which Blue Love belongs. Popular names are not always more understandable than scientific ones. If we insisted upon using the title Milkwort, it would be meaningless to us except indicating to those with a knowledge of English plants that our Love creeper is of the same family.

Purple Heather belongs to the genus *Tetradlea*. Why it is so called will be soon explained. We have about three species of *Tetradlea* in Tasmania. It seems obscure to say about three species, but we must remember species is not a fixed quantity or unit, but simply the nearest we think we can get. Even botanists do not all think alike; the result is they do not all agree as to specific limits. Some reduce our forms to two; others divide them into six. The flower is the same in structure and dispersal in all. There is one in each of the upper leaf axils. The stalk is slender, and the thalamus is not enlarged, so the outer parts are inserted in regular succession close below the ovary. The calyx is formed of four small, separate sepals. The corolla is much larger and, except in dwarf forms, is about half an inch across. The petals are four in number, are free from one another, and alternate with the sepals. They are usually pink or pinkish mauve, but occasionally white. The stamens are of especial interest. There are eight arranged in a single row. Each is quite free from union with its fellows, but they stand upright in a circle round the pistil, and being dark, give a marked colour to the centre of the flower. The filament

is very short, but the anther makes up for this by being relatively long.

This anther is of peculiar structure. It is shaped like a slightly-bent club, and the surface, turned outwards, is rather larger than that looking inwards. If you cut through this anther and examine it with a magnifying-glass, you will find it contains two pairs of tubes running the length of the anthers; an outer pair rather larger, and an inner rather smaller. In these tubes lies the pollen. This four-chambered condition is the primitive form, and the anthers of nearly all flowers are four-celled when very young, only in most at maturity the cells have blended in pairs; in some, as in our Australian Heath family, all four have coalesced to form a single sack. But our Purple Heather retains the original four-celled condition. At the top the anther is very much prolonged, and is paler in colour. This elongation may be easily observed to be a tube open at the top. The anthers do not, as with most plants, split open at maturity, but the pollen escapes through the tube at the top. This form of the anthers has been used in suggesting a name for these plants. The genus is called *Tetralthea*, which means four cases or boxes. Four-cased anthers are not confined to this genus, however.

The pistil is a very small, simple-looking object. It is oblong, and rather flat, and has a slender, simple style at its top. The ovarian part of the pistil contains two chambers, showing the organ to be made up of two blended carpels. In each chamber there is a single ovule suspended from the top. In fruit the pistil does not alter much in character; it only enlarges, and the walls become hard. At maturity it splits along each edge to allow the solitary seed to escape from each chamber.

The prettiest of our *Tetraltheas* is *T. ciliata*, but unfortunately it is only found near the north coast. It has relatively large flowers, and the leaves are placed four together, at intervals. Our commonest is *T. glandulosa*, so named because the flat leaves are rough, with little gland like asperities. It is very common even on dry hills. The other plant may be considered variable, or to be composed of two or three species, or united with the last, according to the idea of each student. Its leaves are narrow, with the margins bent back towards the centre, often somewhat hairy, from which it received the name *T. pilosa*. This plant on wet heaths and mountain plains is often much dwarfed, and smaller in leaf and flower.



PURPLE HEATHER.
(*Tetralix pilosa*, Lab.)

[See p. 51

Blue Love is also often called Love Creeper, which is a more appropriate name, because the flowers are not always blue; they are sometimes white, and rarely pink. Young botanists should again remember that colour of flowers does not mark a difference of species. Though certain flowers are more or less restricted in this, for instance, no blue Rose or yellow Aster has yet been developed, yet probably all plants may produce white flowers. If a blue Rose or a yellow Aster were evolved, it would not be a new species, but only a garden variety.

Though the flower of Love is so very different from Purple Heath, the structure of the pistil, fruit, and seed are so similar that they are considered to be very closely related. Love is a small creeper with few small leaves. By means of a twining habit it climbs up the undergrowth for 2 or 3 feet, and bears abundance of pretty little flowers, extensively dispersed, on its branches. Its habits is very much that of a parasite, but it is not one; it only clings to other shrubs for support. The flower is very irregular and difficult for the beginner to understand. At first sight it may be taken for a peaflower, but this is only a first impression, for it really is not at all like one; yet this has been seized on by examiners to catch an unwary student.

There is not here the clear distinction of calyx and corolla we have hitherto met with. The calyx consists of five free sepals—three outer small ones, then two that are relatively large and spreading. They are coloured and look like petals, which they are commonly taken for. There are only three petals, the outer one of which is below, and is larger than the others: it is folded into a boat-shape, and resembles the keel of a peaflower. The two other petals are small, placed at the side, and partly united to the stamens. The stamens are eight in number; their filaments are united below in a sheath that surrounds the pistil. The anthers are very small. This pistil consists of two carpels that are blended together; the lower or ovarian part has two chambers, in each of which is developed a solitary pendulous ovule. The style is short and curved, with a relatively large two-lobed stigma.

In growing into the fruit the pistil does not much change, except that it becomes larger and tapers below into a stalk. When mature it becomes dry, and splits along each edge to allow the two seeds to escape. The seeds are hairy, often copiously so. This is very marked in Love Creeper and its immediate relatives, and the genus from this has been named *Comesperma*, which means hairy seed.

Love has also been named *Volubile*, from its twining habit. Its full botanical name is therefore *Comesperma volubile*.

The genus *Comesperma* is also strictly Australian, but the family to which it belongs, namely, the *Polygala* or Milkwort family, is of worldwide distribution.

We have three or four other *Comespermas*. The prettiest is Purple Broom. It is not a Broom, and it is not purple; but it is a very pretty shrub for all that, with numerous dark-pink flowers, reminding one at a distance of Native Indigo. There are also two insignificant little forms found in heathy country. These plants are evidently structured for insect fertilisation; probably by hover flies and small beetles. There is a large field of observation awaiting an enthusiast who will patiently study the habits of insects visiting our native flowers. It is very instructive to note the contrivances to insure the ovules being fertilised by pollen brought from another flower. The simplest measure is for pollen and ovules to be produced only on separate blooms. We have noticed this in *Clematis* and *Manuka*; it is much more distinctly the case in *Sheoak*. A more common way is for pollen and stigma not to mature at the same time. In *Lobelia*, *Trigger Plant*, *Daisy*, and a host of others the pollen is shed some time before the stigma is receptive. In *Plantain* or *Ribgrass* the stigma has passed its effective stage, and shrivelled before the anthers are mature. Another manner is for the anthers and stigma to be so placed that the pollen cannot get on the stigma by any ordinary means; this occurs in *Violet*, *Iris*, and *Orchids*. As a last method we may note that for some unexplained reason pollen may be incapable of effectively fertilising the ovules of its flower. It is possible this is the case with *Gum* and *Wattle*, but has not been enquired into.

Now, it is very apparent cross-fertilisation must be of great value to plants, or how would all these measures to ensure it have developed? They are not a meaningless lot of developments that can be classed amongst the accidental, for they have a well-marked purpose. Crossing produces more and better seed. Under unusual circumstances it may be responsible for variation by the production of seed from rather unlike parents; but under free and unrestricted crossing it can only have the effect of breeding out the unusual, and keeping the species oscillating about the mean. It will then be an effective means of suppressing variation and keeping the race close to a type.

Crossing is not an absolute necessity with plants. Not only do many appear quite indifferent, but in some instances, marvellous as it may seem, special provision is made to prevent crossing. Some Violets only produce fertile seed in flowers that do not open and whose ovules can only be fertilised by their own pollen. The same often occurs in one of our Hibbertias. Further, in the enormous class of Fungi, in which there are already forty thousand described species, fertilisation of any sort is seldom known, yet they go on for generation to generation living their lives and doing their work, quite indifferent to the perfection of their celibacy.

Chapter X.

BORONIA.

The genus *Boronia* contains about sixty species, but they are all confined to Australia, though within the limits of the Commonwealth they are very widely dispersed. It belongs to the family Rutaceæ, a large, very natural group of worldwide distribution, so named from Rue, a common European herb. The citrus fruiting shrubs, Orange, Lemon, and such, are well-known members of the family. All the group are noted for the aromatic properties they possess. This, generally, is apparent in the oil dots in the leaves and on the green stems, a condition we have already met with amongst the Myrtles.

We have six forms of *Boronia*, besides many other shrubs belonging to closely-related genera. All the *Boronias* have their leaves placed in opposite pairs. In some species the leaves are of simple outline, while in others they are divided into linear segments. The form that is most likely to be gathered by a young student is the one commonly known as Pink *Boronia*. It is commonly divided into two or three species, a fact that need not trouble us here. The leaves are divided into five to nine linear leaflets arranged in pairs. The flowers are pink, or nearly white, and borne in little loose bunches in the upper leaf axils. In general appearance the structure is very much as we found it in Purple Heather. The sepals are four, and inserted close below the other parts at the top of the flower-stalk; that is to say, the flower-stalk does not expand above into any form of tube as we found in Roses and Myrtles. The petals are also four in number, and are quite free from one another. There are eight free stamens. The filaments are well-developed, and bear gland-like nodules on their surface, besides being adorned with delicate hairs. The anthers are small, round, and inserted a little below the apex of the filament. The pistil is not at all sunk in the thalamus, and is formed of four distinct, or nearly distinct, carpels, which have one common erect style with a round terminal stigma. There are two ovules formed in each carpel.

Between the stamens and pistil there is developed a thick fleshy ring, called a disc. Its use appears to be to supply attractive juice to visiting insects. This disc is a

marked feature, not only of this, but several adjoining families. It is not one of the typical parts of a flower, but is so constant amongst these families as to be of considerable use in classifying them.

In fruiting the carpels are not much changed; they only become larger and tougher, and split at maturity in two, to allow the seeds to escape. Very commonly only one or two of the carpels set seed, when the others appear only as little shrunken objects. Pink *Boronia* may be considered as one variable species, or many distinct ones, according to the disposition of the observer; but whichever course is pursued there is only a trifling and inconstant difference in structure. Our commonest form (*B. pinnata*) is a small erect shrub, bearing copious flowers, which generally are quite half an inch across. It is mostly found towards the coast. In wet places inland is another form (*B. pilosa*) of more slender habit. It is more clothed with hairs, and has smaller flowers; the first pair of leaflets are placed lower down the leaf-stalk than in the last, and the filaments are less hairy. A third variety is plentiful on some mountain plains. It is very like the first, only is less erect and the leaflets are more fleshy and often reduced in number; but it is chiefly noticeable for emitting a strong odour of citrons (*B. citriodora*).

We have two little *Boronias* very common in sandy places and wet heathy country, with white petals often not larger than the sepals and simple narrow leaves. They bear few flowers, and those are placed singly in the leaf axils. Being small and of no great beauty, they are easily overlooked, and have not received popular names. The other two species are not sufficiently common to some within our range.

A common shrub in the bush, belonging to a neighbouring genus, has received the very unpleasant name of Stinkwood. This name is too well fixed to be successfully changed, so, with an apology for its vulgarity, we must use it. Stinkwood is a tall shrub, with opposite leaves each divided into three rather large flat leaflets. The flowers are about a third of an inch across, white, and many together, in branched inflorescences, placed in the upper axils. They differ from the structure of *Boronia* in little except that there are four stamens instead of eight. The plant owes its name to the odour given forth when the leaves are crushed, which most people consider unpleasant. It has often been blamed for poisoning cattle, whether rightly so is not proved; but it is at least probable that it may so act when a beast is in low condition has little else to eat.



LANCEWOOD.
(*Eriostemon squameus*, Lab.)

[See p. 60

Many different plants are from time to time blamed for the death of stock. Proof is very simple, and it seems a pity experiments are not carried out to clearly decide which of our plants are injurious.

Another genus allied to *Boronia* is *Eriostemon*, which may be translated to mean Lovely Stamen, yet it must not be considered to mean its stamens are more beautiful than those of *Boronia*, for they are not. The principal mark of difference is that the leaves are of simple outline instead of being divided, and are arranged alternately instead of in opposite pairs. The flowers also have generally five sepals and petals and ten stamens; otherwise they are as in *Boronia*. We have seven *Eriostemons*; the commonest are Wax Flower and Lancewood.

Wax Flower is a pretty little shrub, which prefers to grow almost flat on the ground. The leaves are small, and they are covered with little oil-bearing knobs. The flowers are very pretty, with five waxy white or pink spreading petals. Lancewood, also called Hickory, is an erect-growing shrub or small tree, with flat lance-shaped leaves, which are silvery-white on the under surface.

Native *Fuchsia* does not look at all like *Boronia*; from a distance, and only from a distance, it looks more like a *Fuchsia*. When its structure is carefully examined its true relationship is apparent. It belongs to the genus *Correa*, which is an easy name, and for the sake of accuracy its use should be encouraged. We have three common *Correas*, two of which may occur in almost any locality; the third, *White Correa*, is confined to the sea coast. The two of wide distribution are so much alike that they pass for one kind in general talk, and together are referred to as *Fuchsia*. The leaves are opposite, broad and flat, or marked with blisterlike convexities. The flowers are peculiar. The calyx is like a small brown cup with four minute teeth. The petals, of which there are four, are about an inch long, and united for the greater part of their length to form a tubular corolla, which is generally green or yellowish, but sometimes crimson, or partly so. The eight stamens have long filaments. The pistil is shaped as in *Boronia*. *White Correa* differs in the petals being white, free, and spreading from the base. The flowers in this genus are usually solitary in the upper leaf axils, or may terminate the branches.

Years ago people had great faith in the medicinal properties of plants. Virtue of some sort was supposed to belong to the extracts of nearly all. Then such a family



NATIVE FUCHSIA.
(*Correa speciosa*, Ait.)

[See p. 60

as Rutaceæ, which is marked by many odours, some pleasant, many otherwise, and all of an abominable taste, commended itself greatly to the credulous. Any disturbance of the functions, if it did not kill, was supposed to be of benefit. There is little doubt that as far as mere disturbance is concerned, this family is eminently suited to do that. But the more scientific the medical profession has become, the more has it lost faith, till now the greater number of the nasty-tasting herbs are left alone. In any family producing aromatic oils, such as this and the Myrtles, the production never appears to be confined to one oil. Each species, or group of closely allied species, certainly construct the same, and that without any reference to the soil in which the plant lives; thus, Peppermint Gum and its immediate allies produce one group of extracts which differ from the extracts of any other Eucalypt, so that it would be quite possible to identify such a Gum by analysing its oils. But though the product of a plant is constant in character, sometimes a peculiar oil crops up in plants of many different families. The extract that gives us the scent of citron is not only produced by Citron, but by the Boronia we have referred to, by a member of the Foxglove family, a Eucalypt, a Thyme, and a Grass. These oils appear to be useless by-products formed by the plant in the process of nutrition and growth, and as the plant has no means of throwing them off, it stores them up in cells so as to get them away from its actively-living parts. This would mean such a plant has not the power of making the best use of its food. Such an assertion sounds like rank heresy to those who see a beautifully accurate adaptation in everything. Many explanations have been brought forward to prove these by-products are of great use to the plant. It is sometimes claimed they render them distasteful to animals. Certainly, in some cases, they afford a partial protection, but often, when we desire to gather a sprig of a Eucalypt for our collection, we find not a single twig on the tree whose leaves are not more or less spoilt in shape by pieces that have been eaten out by insects. If browsing animals spare some of our Boronias, it is only because they are too small to claim their attention. It has been suggested that the oils evaporating from a modified atmosphere surround and protect the plant from the injurious effect of intense light. It is probable no one properly acquainted with Australian conditions will waste time in attempting to refute this.



WAX FLOWER.

(*Eriostemon obovatus*, Cunn.)

[See p. 60

Chapter XI.

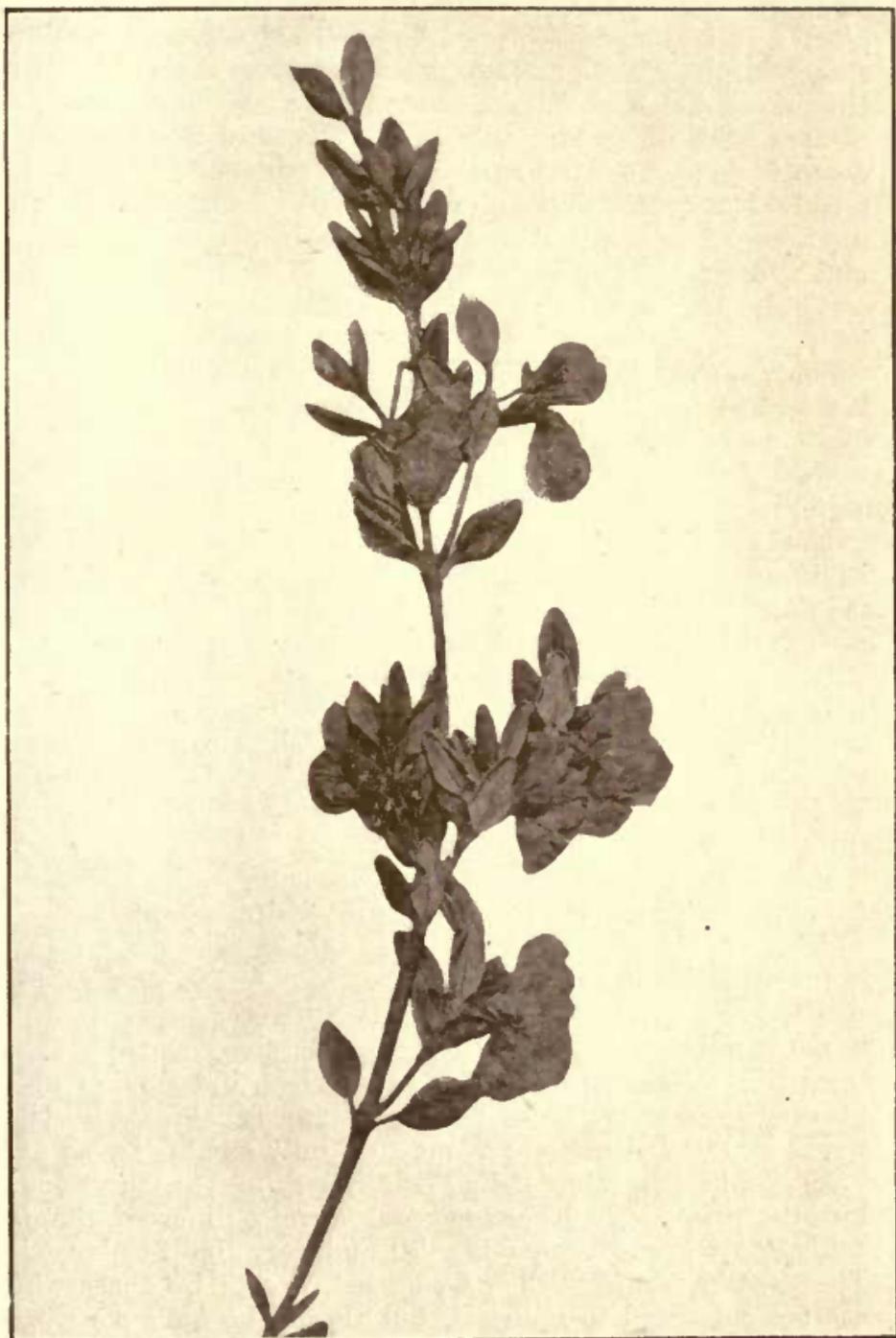
THE SAXIFRAGE FAMILY.

Flowers of this family are not common in most parts of Tasmania, but our forms are too interesting to allow us to neglect them. The family is a large one, and found almost throughout the world, but though it abounds in temperate as well as tropical climates, it is not largely represented in Tasmania.

Though a natural group, there is no mark by which it can certainly be known. As in so many families, it is only by general likeness that we can recognise its members. It passes without break into its neighbouring families, and even with experienced botanists it is often a matter of doubt whether some particular plant should be placed just here or in a related group. *Eucryphia* might with equal justice be placed in this, with the *Roses*, or with the *Hypericums*. Were we acquainted with no *Saxifrages* except those of Tasmania there would be no sufficient reason why they should be placed in a separate family from *Roses*; it is upon the common habit of forms in other countries that the family is established.

We have five species, and each belongs to a separate genus. Of these, four should claim our attention. They are *Native Laurel*, *Horizontal*, *Eucryphia*, and *Bauera*.

Laurel is about, if not quite, our prettiest wild flower. It grows in woodlands on our hillsides, and attains the size of a large shrub in favourable places, but it has too branched and spreading a habit to grow tall. The leaves are clustered towards the ends of the branches and are placed alternately. They are large, flat, and marked along the border by short, blunt serrations. There are many flowers in loose bunches which grow from the ends of the branches; each is nearly an inch in diameter when fully out, and is white or tinged with pink. The *thalamus* is expanded into a short tube, which is blended with the base of the pistil. The calyx appears as a continuation of it, so that it is impossible to say where the tube ends and the calyx begins. There are generally six sepals, but the number is variable; they are green, and not conspicuous. The petals are the same number as the sepals; they are broad and spreading. There are also as many stamens as



BUCRYPHIA MILLIGANI, Hook.

[See p. 64

petals; they are of medium length and of no exceptional structure. The pistil, except at its broad base, is free and erect. It is composed of two blended carpels, and, unlike those plants we have already described, they are so blended that the ovarian chambers are combined to form a single cavity; the numerous ovules arise along two lines running down its side. The style is single, but it has a two-lobed, terminal stigma. The pistil does not change much in maturing into fruit; it only becomes larger and tougher, and when ripe it splits along the junction of the carpels, each curving back to allow the seeds to escape. These have a well-developed membranous wing on one side, which enables them to be dispersed by the wind. Laurel is confined to Tasmania, and the genus contains only one other species, which differs but slightly from it and has a very restricted home in Southern Queensland and the adjoining part of New South Wales.

Horizontal is a most interesting tree, in a genus all by itself, and occurs nowhere but in the western part of Tasmania. In fairly open forest it is an erect tree, with a rather thin stem, but where it thrives most is in damp, still valleys. There it grows rapidly, and its slender stem is bent to the ground by the weight of its crown. From this arise numerous erect branches, which in turn lay themselves flat and continue the same process. This forms an impenetrable shrub, which a traveller has either to cut a tunnel through or climb over.

Each of our Saxifrages has a character quite different from the others. Horizontal has opposite, simple leaves, which are oblong, thick, marked along the margin by blunt serrations, and 1 to 2 inches long. The flowers are small, green, and placed one or two together close in the upper axils. The sepals are four or five, and broadly spreading. The petals similar in number, but smaller and narrow. There are twice as many stamens, and the pistil, which is like that of Laurel, matures only one or two seeds.

Eucryphia is often called Pinkwood, or Leatherwood, but the original Leatherwood was a very different plant, belonging to the Boronia family, and very like Stinkwood. The name Eucryphia should be used, except by those who are too conceited to improve, but those who have a rooted objection to what will assist accuracy may call it Pinkwood without causing much confusion. But even this is objectionable, for *Beyeria*, one of the Euphorbia family, is also called Pinkwood. It is found only in the western

half of Tasmania, but there grows from sea-level to almost the tops of mountains. At a low altitude it is a medium-sized tree; at a high one it becomes almost a procumbent shrub. The leaves and flowers also become smaller as a high elevation is reached. This change of feature is not exactly in proportion to altitude, the two forms often overlapping; in consequence of this some people prefer to treat them as separate species. The leaves are in opposite pairs, oblong, with a plain margin, pale on the under surface, and from $\frac{1}{2}$ -inch to 2 inches long, according to locality. The flowers are nearly an inch across, and are placed singly in the upper axils. There are four small sepals, and a similar number of large white petals, which give the flowers much the appearance of apple blossoms. The stamens are numerous, forming a circle round the pistil. This latter organ is not at all sunk in the thalamus, and is composed of five slender carpels united along their inner sides. Each has its own style and stigma, and the ovarian cavities are not blended as in the last two genera. The fruit differs little from the pistil of the flower, except in being larger and tougher. There are few seeds in each chamber; they are flat, with a well-formed membranous wing at the upper end.

Bauera, also called Native Rose, is, when commonly met with, a pretty little trailing shrub with slender wiry stems, often supporting itself amongst the undergrowth, but under favourable conditions it will spread for many yards, and when luxuriant forms a dense mass of wiry shrub that it is next to impossible to break through. The leaves are comparatively small, and divided into three narrow, equal segments, and as they are placed in opposite pairs, it gives the appearance of having them in circles of six small leaflets arranged at intervals. The flowers are white or pink, and sometimes double, each on a long slender stalk placed singly in the upper axils; they are about half an inch in diameter. There is a plant with yellow flowers and very similar in general appearance, but with simple leaves, which goes by the name of Yellow *Bauera*. It does not belong to the genus, but is a *Hibbertia*. There are generally six or seven small sepals. The same number of rather broader, larger petals, and very numerous stamens inserted on a fleshy disc. The pistil consists of two carpels blended, but with distinct styles and ovaries. The seeds are numerous and without wings. *Bauera* is the only one of our Saxifrages which is found

outside Tasmania, and it extends only to Victoria and New South Wales. Tasmania is exceptionally rich in species of plants that are confined to its area.

We have noticed that in Wattles and Myrtles the foliage is greatly reduced and otherwise modified to suit a climate of excessive sunlight. In the interior of Australia it may be an adaptation to dry soil conditions, but there is no reason to assume that dryness has been the main factor with us. A clear dry atmosphere with considerable temperature is injurious to broad delicate leaves; but in our Saxifrages, though the leaves are not very delicate, they do not show any great effort to reduce exposed surface and evaporation. This mixture of broad-leaved forms suited to mean climatic conditions with others modified to withstand excess is found also through all coastal districts of temperate Australia. We find in these districts that broad-leaved European plants do well; they are not much affected even in a hot, dry summer, provided root moisture does not sink too low. In other words, Tasmania and the coast of Australia have now a climate suited to broad-leaved plants. Why have we then a preponderance of reduced, thick-leaved types? Are they the survival of a former condition, or are they migrants whose hardy nature has enabled them to oust more efficient but less vigorous species? The migration of plants is a most interesting study, but conclusions should not be formed hastily.

A plant, other than one only suited to live in water, is provided with a skin which is somewhat analogous to the skin of an animal. Its two principal functions are to protect the soft parts from injury, and to reduce indiscriminate evaporation. Except in some lowly plants, as Mosses, death will ensue if dried by excessive evaporation. The skin effectively prevents this, but as a thick skin brings special disadvantages with it, we generally find species of plants whose natural habitat is a moist, shaded place, or a country with a persistently cloudy sky, have thin skins. Even the same plant will often respond to these conditions, developing a thinner skin if grown in shade than when freely exposed. Though the skin is never absolutely impervious, it is nearly so. In a plant well suited to its surroundings practically no evaporation takes place from the surface; but a plant, in order to live, must draw in through its roots a great quantity of water with dissolved material. And it must get rid of this water by evaporation from its green surface, or the absorption will soon come to a standstill. This evaporation is carried out



BAUERA.

(*Bauera rubioides*, Andr.)

[See p. 67

by innumerable minute pores on the surface of the leaves and green shoots specially constructed for the purpose. These pores are so small that they require a strong lens to show them, yet they are wonderfully constructed. They are not permanent openings, but each has a pair of lips which are capable of opening or closing just as the lips of a mouth. When exposed to light the lips open and the moisture within the tissues can freely evaporate through; when the light fails the lips close together and stop the process. These little pores, from their peculiar structure and function, have received the name of stomata, which means mouths. Each is a stoma. A stoma has another function equally as important to a plant as allowing the escape of moisture, namely, to allow the passage inwards of air. If you take a plant and thoroughly dry it its weight is reduced very considerably. Now, if it is baked at a considerable heat, but not burnt, it will turn black, or, as we may say, turns into charcoal. Chemists call charcoal carbon. By far the greater portion of the dry part of a plant is carbon. A plant absorbs practically no carbon through the roots; it is all procured from the atmosphere, which enters the green parts through the stomata. As there are on the average only four parts of a gas containing carbon in ten thousand parts of air, it can well be imagined what a quantity of atmosphere must in a year pass in and out of the stomata of a tree to supply its yearly wants.

The carbon of a plant is first reduced from the carbonic acid of the air and then built up by a complicated process with molecules of water to form complex substances in the green tissue: these first appear to us in the form of starch or sugar. This is afterwards used up by the plant to form its multitudinous compounds, or as fuel, to supply energy for growth. What we want to note here is that this marvellous building up of substance only takes place in the green tissue of plants. As all familiar plants are green, we generally take the colour as a matter of course, but it is worthy of the most grave consideration. The green colour is due to a definite substance, plant-green. This substance has the power, when light is sufficiently intense, of splitting up carbonic acid and forming starch or sugar, from which the higher compounds are then formed. Plant-green is the only known substance that has this power. Wherefore not only all plants, but also animals, depend for their existence upon the action of the green tissue of plants.

Chapter XII.

THE PROTEA FAMILY.

This family is a large one, and though containing great variation in its flowers, they all conform to one type. This so clearly marks it off from all others that there is never a doubt as to whether a plant belongs here or not. The distribution of the family in the present day is almost confined to South Africa and Australia; a very few forms are also found in South America and as far north as Japan. We have twelve genera, and those most likely to be noticed are Honeysuckle, Hakea, Guitar Plant, and Waratah.

The family owes its name to Protea, a South African genus, which we sometimes find in our gardens. Protea was given to it to mark the many forms assumed.

The whole family can only be assumed to have descended from a common stock, and as fossils undoubtedly belonging to it have been discovered as far back as the Cretaceous period, we are forced to the conclusion that it is an ancient family that has migrated in response to changed conditions. There are a great number of species both in Australia and Africa, but there is not a single species, not even a genus, common to both regions. The two places have their own peculiar forms, and they are also separated geographically, as no members of the family appear between East Asia and Africa. The two groups mark lines of migration in remote times.

All members of the family have thick, hard leaves, which in many cases are greatly reduced in surface. They appear to have been adapted to dry, sunny conditions in the life of their earliest ancestors. On Acacias and Myrtles we found the same condition, but not as consistently. Many forms of these have fairly thin leaves, but amongst the Proteas all, without exception, have thick leaves with impervious skins. It may be asked why, if a race can acquire a foliage suited to reduced evaporation when surrounding conditions require it, it does not again assume thinner leaves when in a region of milder climate? The reason is probably that in the first case it was a matter of life or death. Only a race could maintain itself that had a tendency towards economising its water-supply; while in the latter it can still live at least till the crowding



RASPBERRY JAM WOOD.

(*Alyxia buxifolia*, R. Br.)



SEBAEA OVATA, R. Br.

of more luxuriant forms will in a struggle for space smother it out of existence. We see this latter result constantly taking place about us. Introduced plants have a common habit of ousting natives. We see in our settled parts the steady suppression of the original herbage by the more vigorous European weeds. In the struggle for existence there is only room for the fittest; all the others have to go under. In nature there is no sympathy for the weakling.

The flowers of the family are all of one type, though there is great difference in detail. The first thing we may notice is that there is not both a calyx and corolla. We find only one circle, and in order not to trouble whether this is one or the other we call it a perianth. In older botanical works when this was the case it was called a calyx, though it may look more like a corolla. The perianth in this family is made up of four parts or segments, which are usually united in a tube below and free above. There are four stamens, and their commonest position is one upon each segment; often they are placed in little depressions close to the tip of each. The pistil consists of a single carpel, placed in the centre of the flower; it may contain few or more ovules. The fruit is variable; it may be fleshy outside, a thick wooden body, a leathery capsule, or some other form.

Waratah, though not our commonest form, is the easiest to examine. On our mountains it is a shrub, but in more favourable situations towards the west it assumes the state of a small tree. The leaves are simply shaped, much longer than broad, dark-green, and of hard texture. The flowers are in dense terminal heads, bright crimson, rarely white. A plant of rather different structure, with flowers arranged in linear spikes, is often called White Waratah in the West.

The perianth of Waratah consists of four rather long, narrow, crimson members, which in the bud adhere to one another along their margin. While still in bud it may be observed that at the end it is rather enlarged and round; also, as it approaches maturity it is bent to one side. The flower opens by the four perianth segments, separating, and sharply coiling back. Now the reason of the terminal thickening is shown. The end of each is like a spoon, with a stamen in it. It is obvious also that the curving was caused by the style, which had grown long while yet in bud, and now stands freely up in the centre of



WARATAH.

(*Telopea truncata*, R. Br.)

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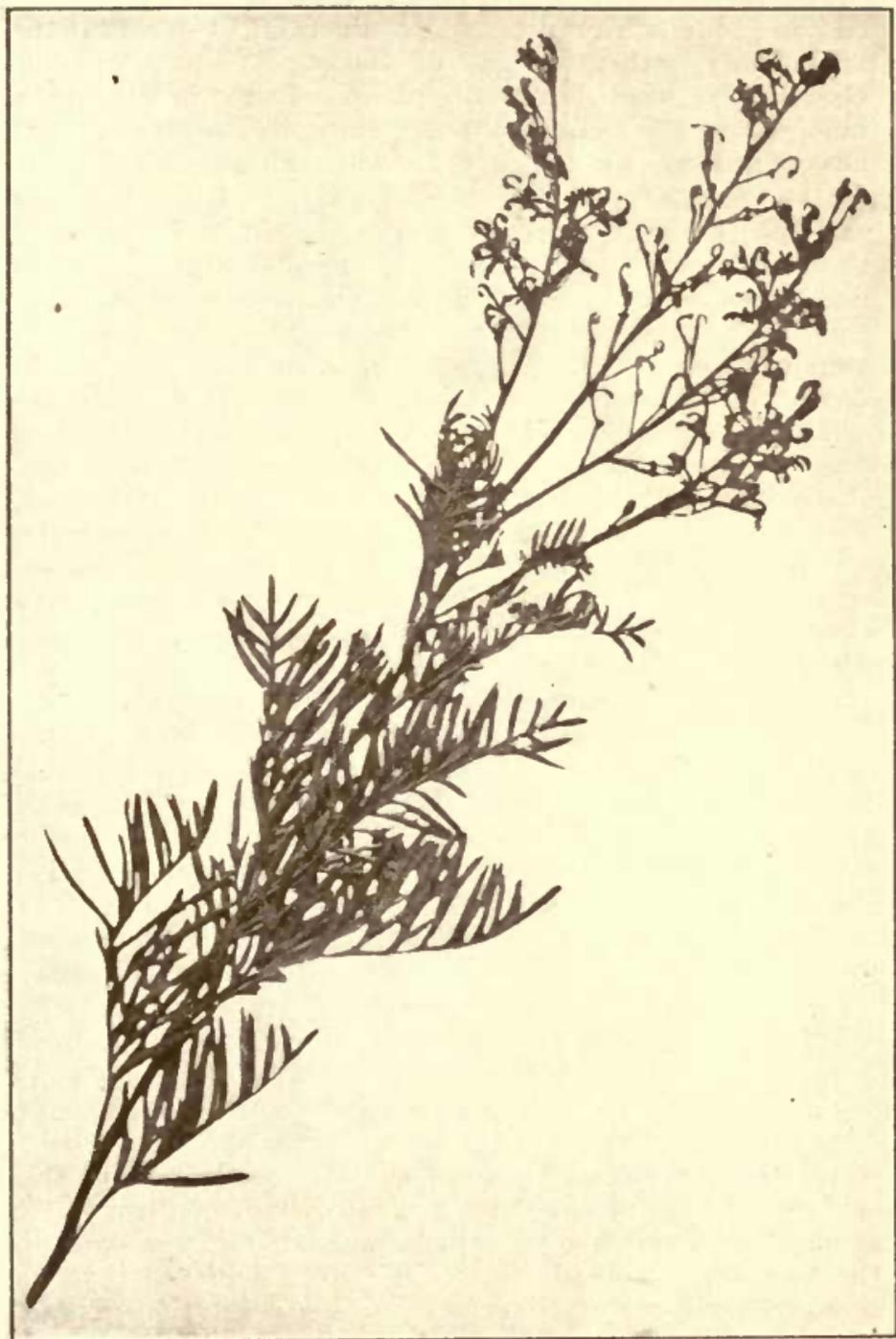
each flower. The ovules are very numerous, and arranged in two rows. They are minute at the time of flowering, but easily observed in the fruit, which is very like a curved leathery bean, from 2 to 3 inches long, which splits open to allow the seeds to escape. These have a well-developed wing on one side, which greatly aids in the dispersal of the seed by wind.

The flowers develop a considerable amount of honey, and are much sought by honey-eating birds. Being closely packed to form a large head renders them conspicuous at a considerable distance. This is a common habit with plants, and greatly aids the purpose of attracting visitors.

Guitar Plant is widely dispersed. It is also called Fairy Fern, because its leaves have sometimes a remote resemblance to those of a fern. It is always a small shrub, and the leaves are variable in shape, being sometimes quite simple, at others very divided. The flowers are cream-coloured, many, in loose masses, and shaped otherwise just as in Waratah, but the fruit is much smaller, and when open somewhat resembles a guitar.

Hakea is, from the shape of its fruit, often called Native Pear, but as this name is also given to two or three other shrubs we may be excused for dropping it in this instance. We have no less than seven members of this genus. One which does not occur south of Bass Straits has narrow but flat leaves, but the rest have all similar foliage, namely slender cylindric needles, assuming somewhat the appearance of a Pine. Our common Hakea is a rather large shrub. The flowers are small, white; and arranged in little axillary clusters. Though small they are structured just as in Waratah. One difference may be noted, and this is found in many genera of the family: they are arranged in pairs; that is, however dense the cluster, it is made up of pairs of flowers. The fruit is very different from that of any other shrub we shall meet with; it is a wooden ball about an inch in diameter. When ripe it splits in two, exposing two flat black seeds that have well-developed thin wings on one side.

Small-fruited Hakea grows in marshy places. It is a smaller shrub, and the fruit, which is about half an inch in diameter, is not so woody. Dagger-fruited Hakea is less common. The leaves are rigid and sharp, and the fruit is dagger-shaped. Another form has a small fruit sharply curved at the base. The two remaining species are rare, and appear only to have been gathered on the



GUITAR PLANT.
(*Lomatia tinctoria*, R. Br.)

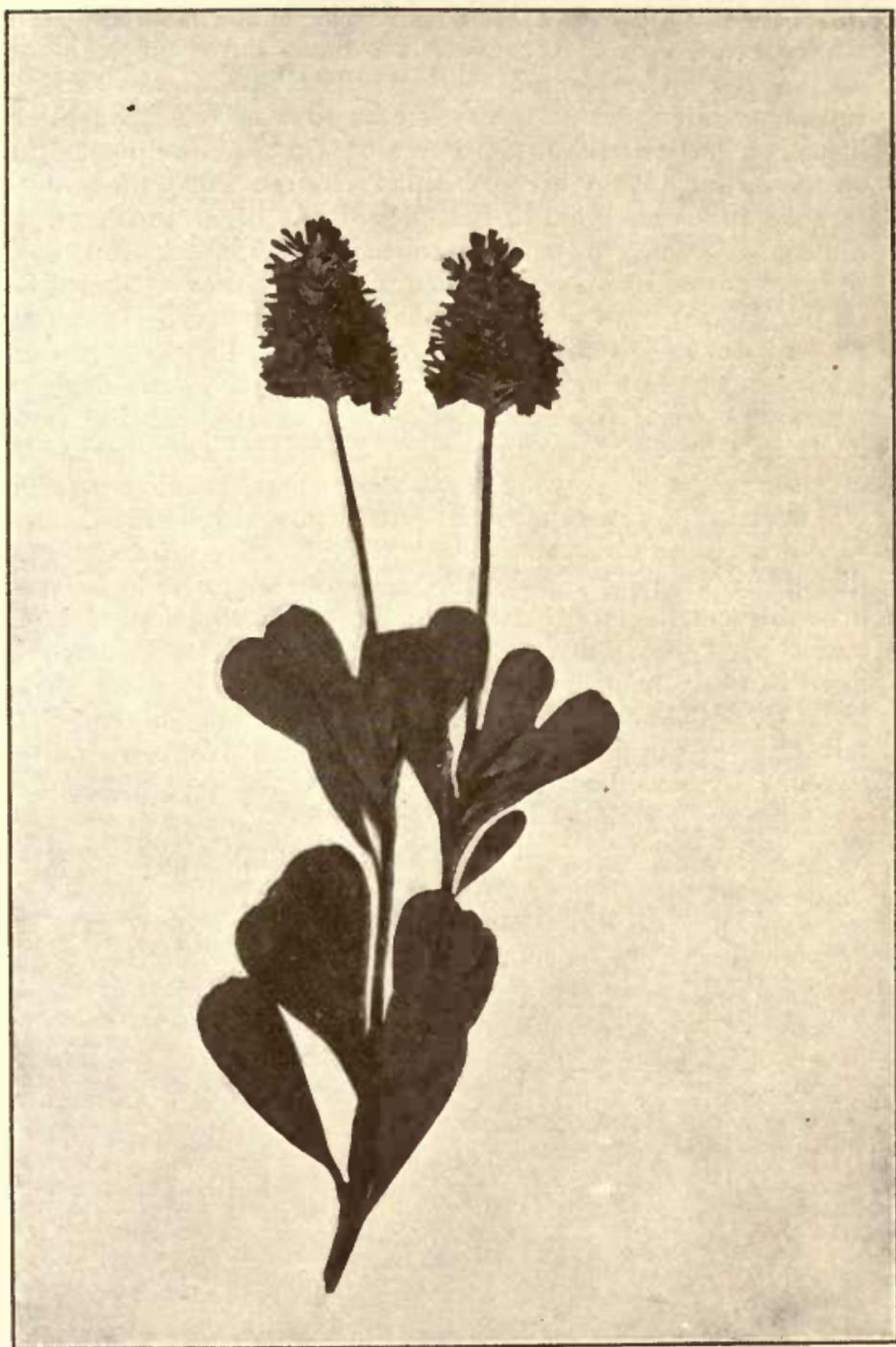
[See p. 71

North-East Coast. Many of the *Hakeas* of Australia have broad leaves. This genus is very close to the large Australian group of *Grevillea*, which differs in little except the fruit being leathery instead of woody. We have but one *Grevillea*, a small mountain plant. *Orites* is with us a much more common mountain genus, but it has straight flowers instead of much curved, as in our *Grevillea*.

Honeysuckle is a very common tree. The leaves are variable in shape, narrow or broad, toothed or plain on the margin; the end appears as if cut off abruptly, and the under-surface is nearly white and closely netted by the veins. The toothed leaves are generally only found on very young specimens. The flowers are massed together in dense, oblong cones; as in *Hakea* and *Grevillea* they are arranged in pairs in the cones. The styles are very long, forming conspicuous objects in the flowering stage, otherwise they do not differ from the form described. The fruit is a rather large flat, almost woody capsule, which on splitting exposes two winged seeds. A few of these fruits may generally be seen on most old cones. We have only one common Honeysuckle, but there is a second whose leaves are always serrated, and whose cones are very large, that occupies a small area near Table Cape.

We have a few other most interesting members of this family. Mountain Rocket is common on elevated plains. It is generally a very small shrub with numerous pink and white little flowers in a head on the end of an erect stalk. The fruit is flat, bright-red, and soft. Native Plum is confined to the west. It is very like Laurel, only the leaves are larger, flowers inconspicuous, fruit a small purple plum. *Persoonia* is a small bush with small spiney leaves, yellow flowers, and fleshy fruit.

When we speak of the migration of Australian and African *Proteas* from a common northern source we convey an idea of simplicity probably not at all in accordance with the true state of affairs. There has not been a constant advance in even general climatic conditions on the surface of the globe, but a complicated oscillation of general and local changes, which have left but few signs of their existence behind them. We have evidence that in comparatively recent times a luxuriant vegetation existed even in polar regions, followed by arctic conditions extending towards the tropics. The same alternations seem to have occurred right back in very early times. The luxuriant vegetation of the Carboniferous era was suc-



MOUNTAIN ROCKET.

(*Bellendena montana*, R. Br.)

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ceeded by the frigid conditions of the Permian. What number of such cycles have filled the space between, and what have been the causes, we have only the vaguest notion. Another factor of plant-distribution, the oscillation between land and sea, giving freedom of migration at one time with close isolation at another, we have but scanty information of. A third change that must have largely influenced plant life, condition of atmosphere, is almost a closed book. There is one thing certain—the present constitution of the atmosphere, however agreeable to us, is far from the best for plant life. There are at present on the average but three and a half parts of carbonic acid in ten thousand parts of air, yet plants do best when this gas is present to an extent even exceeding four parts in a hundred, or more than a hundred times as much of this gas. The presence of a larger proportion of this gas than at present obtains would not only afford more food for the plants, but would much modify climatic conditions, rendering it warmer and more equitable. It is probable that atmospheric conditions, distribution of land and sea, together with large cycles due to other causes, have caused oscillations of climate of which we can form but the slightest conception. Thus the evolution and distribution of plants is a far more profound problem than it is generally considered.



DAGGER HAKEA.
(*Hakea pugioniformis*, Cav.)

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Chapter XIII.

THE COMPOSITE FAMILY.

The object of the beautiful colour of flowers is to render them conspicuous amongst the foliage in order that birds or insects may see them from a distance and be attracted. We call them beautiful because they please us; had it been an advantage to them to have been black and ugly, they would have undoubtedly been so. We are of no consequence to them. They put on their adornments to please beings which to them are of much greater importance.

Some plants have very large showy flowers; others bring about the same result by massing together great numbers of small flowers. Silver Wattle has flowers of very small size, yet we can distinguish a flowering Wattle at a distance of some miles. When small flowers are massed together, this occurs in all conceivable forms of looseness or compactness, according to the species. This is sometimes carried so far that the head of flowers look for all the world like a single flower, and in general talk we speak of it as such. A Chrysanthemum, Dahlia, or Aster is a single flower till we examine it, when we find it is really made up of a great number of minute flowers, which we commonly call florets, because they are small. We respect popular opinion, and still call the whole head a flower, though it is not one. Or we may be a little more accurate, and call it a composite flower.

Composite flowers appear in many different families; but in one in particular. They are almost universal, and it has pleased botanists to call it the Composite Family, though we must remember that all composite flowers do not belong to it. Tough Bark and Pincushion do not belong to it; but the three already mentioned, together with Daisy, Everlasting, Buttons, Dandelion, and a host of others, do. In order to understand the family we must study the structure of a floret. Unfortunately, being very small, it requires strong eyesight or the use of a lens. Take a Daisy flower, and for preference the flower of one of our common Daisy shrubs or the tree we call Musk. Outside is a close arrangement of green bracts, recalling the appearance of a calyx; its purpose is for protection, and is called an involucre. It varies greatly in different kinds flowers. Here each bract is green, tipped with a coloured



HELICHRYSUM DEALBATUM, Lab.

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point. In Everlasting they are large, dry, and coloured. In Thistles they are tipped with spines. The flower itself shows us a circle of spreading white or mauve rays, and a central cushion of yellow florets. If you carefully cut the flower in two and take out one of the little yellow florets, without injuring it, you will find it consists of a fleshy stalk-like base, which will become the seed. At the top of this we find a ring of long hairs; close inside this is a yellow tube, ending in four or five little lobes. The fleshy stalk is the ovary, and contains one erect ovule; the ring of hairs is a very modified calyx; the yellow tube is the corolla. If you split the corolla open you will find it has attached to its inner surface four or five stamens. The filaments are free, but the anthers are united to form a tube, and they open on their inner aspect. In the centre of the floret is a long slender style; it arises from the top of the ovary, passes up through the ring of anthers, and divides above into two spreading arms. It may be here noted that a flower of the Composite Family may always be told from other composite flowers by the union of the anthers; the others have free anthers. Now, examine one of the ray florets. It differs in the shape of the corolla; instead of being tubular it is shaped like a strap, which is usually toothed at the extreme end to mark the petals of which it is made up; also in ray florets the stamens are generally absent or abortive. The fruit is formed of the slightly enlarged and hardened ovary, each containing one seed.

The form of flower, as in Daisy, namely, with an outer ray of strap florets and a disc of tubular ones, is the commonest form met with. In Buttons, a plant of wet localities, with compact yellow flowers, and in the Groundsel of our Gardens, the florets are all tubular; while in Dandelion and its allies they are all strap-shaped.

The ring of hairs we have referred to, and called the calyx, varies greatly in different genera. In Daisy shrub it is very conspicuous; in our little mauve Daisies it is reduced to minute teeth; in the introduced wild Daisy it is absent; in Dandelion it is formed of simple hairs, which, in the fruiting condition, are borne upon a long stalk-giving it the appearance of a parachute. The calyx is persistent on the fruit, and is called the Pappus. When well developed it is of much use in assisting the dispersal of the seed. Pollen is shed from the anthers before the style is fully grown. This organ pushes up through the anther ring, carrying the pollen before it, and by the time



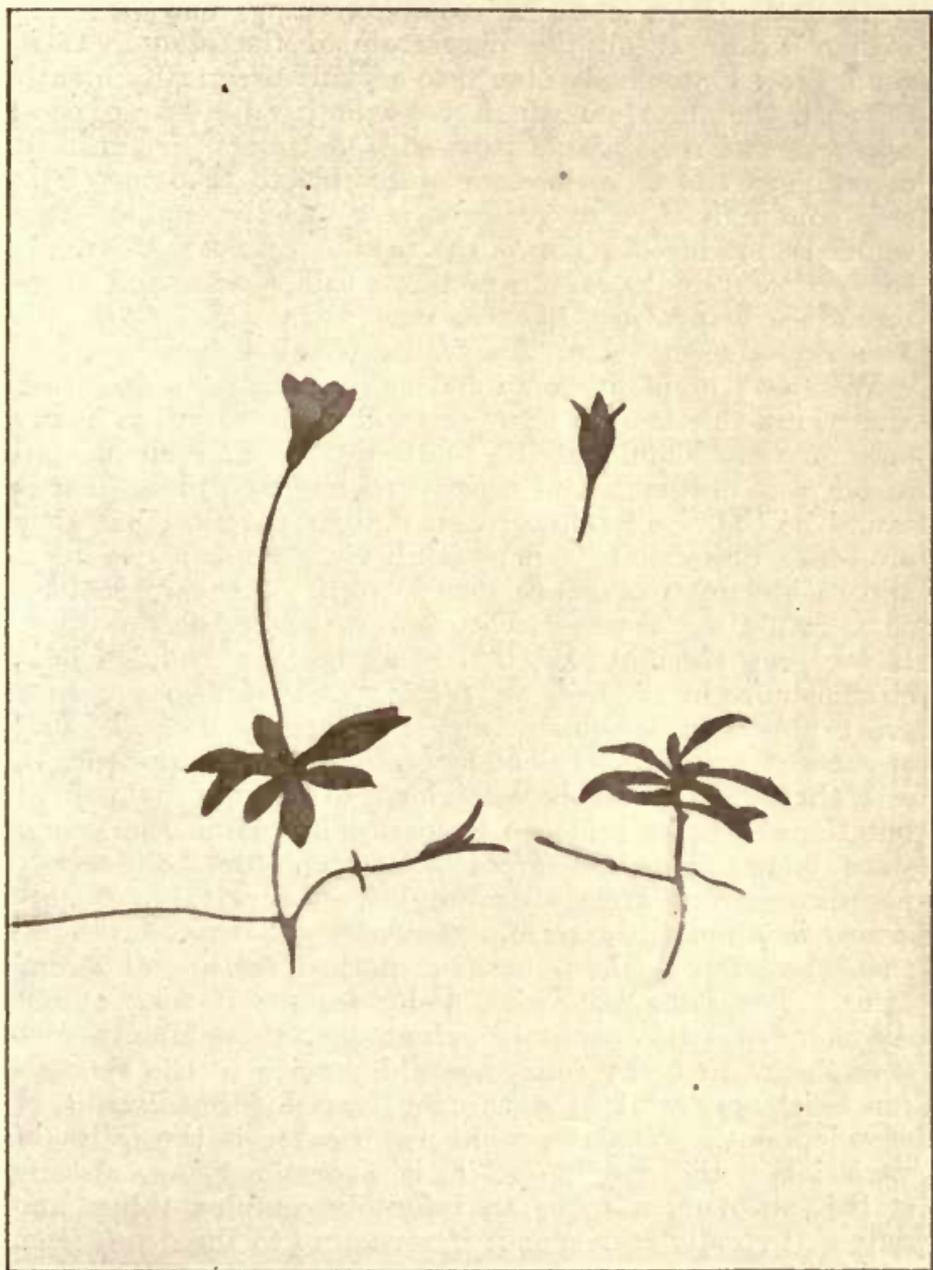
DAISY TREE.
(*Olearia stellulata*, D.C.)

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its branches have spread and developed a stigmatic surface, the pollen has lost its effectiveness. This prevents self-fertilisation. These flowers are most commonly crossed by flies and small beetles, which fly on to the conspicuous head and, walking about, carry pollen from flower to flower.

Although we have a great number of plants belonging to this family, there is so much sameness about their general character that they do not appeal to the sympathy of the wild flower gatherer. To the botanist they are of great interest; but then the student is not in quest of beauty. It is the largest of all families of flowering plants, including about ten thousand plants. Strange to say, in Australia it comes only fourth on the list. We have far more leguminous plants; next comes Myrtles, and then Proteas. Most of the family are herbs; very few attain the dignity of small trees. The herbaceous condition appears to be more disposed to the formation of variety of form than the arborescent state. Shrubs and trees were probably evolved from herbs, but the reduction to the lower form possibly never takes place. If the gradual evolution of flower forms is also carefully considered, it leads to the conclusion that the composite flower is a very specialised type. These considerations have led botanists to conclude that composites are the latest structure in plant development. It is impossible to come to a definite conclusion, for flowering plants have not developed along one course, but many and independently. Of the many lesser lines there are two large parallel sections developing independently of one another, the Dicotyls and Monocotyls, and we cannot form any definite conclusions as to which is the older. Among the latter we shall shortly see that the Orchids have certainly attained as high a degree of complexity as have composites.

We generally speak of the seed of a plant as though it were the start of a new being—as though it were a new creature called into existence. It is convenient to treat it thus, but not very accurate. A seed is the outcome of the coalescence of pollen and ovum, and these are nothing more than portions of the plants from which they are derived carrying with them the characters of those plants. They are lineal descendants without break from the earliest organisms that existed upon the earth. Some naturalists are very fond, because bacteria never produce seed, of exhibiting a little bit of marvellousness in claiming that these beings have been immortal as far as the past is concerned. This is quite unnecessary, as the same can be



WAHLENBERGIA SAXICOLA, D.C.

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claimed for the cells of every plant or animal; they are all descended without break from the earliest dawn of life. An ovum is but a cell of the plant, within which it is formed. It is a highly complex thing, and possesses hidden within it all the characters of the plant. If it could grow it would develop into a plant practically identical with the one from which it was derived, just as is the case when we raise plants from slips or tubers. If, instead of taking a slip of a Rose, we were able to take one of its cells and induce it to grow, a new exactly similar Rose would be produced. This is the regular course with fungi; they release single cells, which we call spores, and these reproduce beings just like the ones from which they fell. This reproduction of similar forms is called heredity.

We speak of plant or animal as inheriting its qualities, and think it strange that one cell can carry so many powers. We should all be in a state of marvellous confusion if it did not. Did no disturbance take place, beings would be the exact counterpart of their parents; but they are never quite that. There is always a tendency to vary, and to account for this tendency is one of those problems that naturalists have not yet come to an agreement upon. It was once thought that if a being became modified by a circumstance of its life, as, for instance, if a man gained great muscular development of his arm by constant use, or a plant formed succulent leaves through the presence of salt, that there would be a tendency to transmit that power; but the weight of evidence is against it. If in the savage state some men had great advantage by accidentally possessing strong arms, there might be a survival of strong-armed men and an extermination of weak-armed brothers; then the tribe would tend to a marked feature of strong arms. The same way with fleshy leaves; if such a condition gave a life or death advantage, those plants with a tendency to fleshy foliage would survive in the struggle for existence, while the thinner leaved forms would be crowded out. What we want to discover is the cause of variations; the result of it is evolution. As already stated, an ovum is to us an infinitely complex thing, and only if it rigidly corresponds in structure to the ovum from which its parent was formed, will it produce a being of exact likeness. An infinitely minute difference in the result and a variation will appear. Probably every seedling that grows is a variation in some detail; it only requires suitable conditions to establish itself, and possibly eventually produce a new species.

Chapter XIV.

SHEOKE AND BEECH.

A most fascinating tree is Sheoke; so also is Buloke. Sombre in appearance and slow of growth, but full of interest to the student. They were commonly called Sheoak and Bull-oak respectively, but as these might lead one to think them related to Oak we will fall in with the names adopted by the Victorian authorities. They belong to the genus *Casuarina*. This genus does not contain many species. It is confined to Australia, the adjoining Pacific, and the East Indies to East Africa. Botanically it is very isolated. It is not immediately related to any other existing group, and it is not possible with our present knowledge to conjecture along what line of descent it has arrived at its present state. Its structure is unique among plants, except that something of a superficial resemblance appears in the Horsetails of the Northern Hemisphere, which are related to ferns, and are a survival of an ancient type which flourished at the period when great beds of coal were laid down. It is quite impossible that *Casuarina* was in any way a descendant from Horsetail; it is only another instance of a similar form having been produced independently.

Sheoke is a small tree. Its ultimate branchlets are very numerous, drooping, and green; they perform the duties of leaves, for those organs are reduced to little scales, useless for any other purpose than to protect the young growing point. The branchlets are slender and cylindrical, and are divided into sections by circles of nine to twelve little teeth-like leaves; they are also grooved longitudinally by as many grooves as there are leaves. Though these grooves appear only as faint lines, they sink for some distance into the substance of the branchlet. There are no stomata on the exposed surface; these organs are placed on the walls of the grooves. It can thus be seen, from the absence of effective leaves and the existence of stomata only on very protected areas, that evaporation is reduced to a minimum, a condition not at present necessary in Tasmania, yet Sheoke does very well.

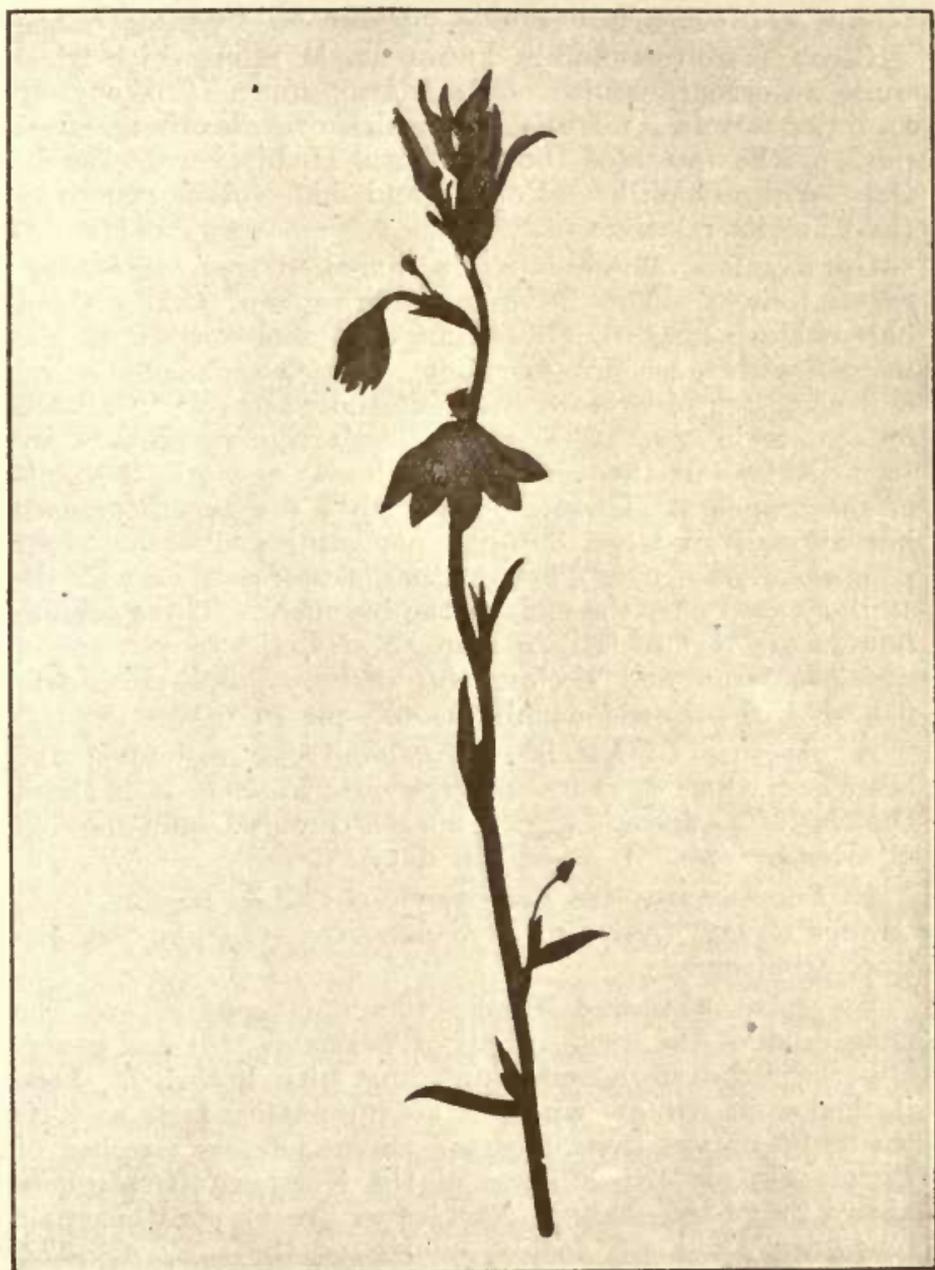
The flowering is very different from any form yet examined. The stamens and pistils are not only produced

in different flowers, but, except in unusual cases, are borne on separate trees.

Each staminate flower consists of one stamen, clothed at the base by a few minute bracts, one or two of which are thrown off as the stamen elongates, and are considered to be the representative of a perianth. The staminate flowers are very numerous in the circles of leaves at the ends of branchlets. The pistillate flowers are also numerous in little lateral cones. Each consists of a minute one-celled ovary, a long slender style with two delicate, red, stigmatic branches; each has three small bracts, but no perianth. When in flower the red styles are very noticeable, but not sufficiently so to attract insects. Fertilisation is effected by pollen being accidentally blown on to the stigma by a current of air. Pollen is formed in immense quantity on a Sheoke. There are certainly many million grains produced for every one that reaches an ovule. If you patiently watch a Sheoke with minute staminate flowers you may notice at every slight puff of air a thin cloud of innumerable grains being wafted abroad, and it is seldom that any of them reach their effective destination. The fruit recalls the idea of the cone of a Pine. It is oblong, about an inch long, and covered with sharp protuberances. The styles have fallen off, but the ovary has become much enlarged, is thick, and ends in a sharp point. When mature each ovary opens in two halves, releasing two winged seeds. The wood is red and beautifully marked with thick radiating rays. It is tough, and valuable for decorative work and furniture. It is an excellent fuel, and it seems a pity it is seldom used for other purposes. The rays are what is known to joiners as silver-grain, and is present in all woods, but in many instances it is too slender to be readily seen. These rays are of use to the tree in affording an easy means of communication between the superficial and deep tissues; they are channels for the transmission of food and air.

Buloke is also a small tree of similar character, but the branchlets are all erect. They are more slender, have only six to eight scale-leaves and grooves, and both staminate and pistillate flowers are present on the same tree. The fruit is smaller, and the ovaries are very short and blunt. Otherwise the details are as in the last.

Dwarf Buloke differs but slightly. It is a small shrub with some pubescence on the branchlets and more succulent cones. It is common in heathy country, and not very distinct from the last.



SCOEVOLA AEMULA, R Br.

[See p. 94

Casuarinas have much the appearance of Cypress and Pine, and they show some details common to these. The structure of their organs and tissues is, however, very different, and there is probably no true relationship.

Beech is unfortunately known as Myrtle, which gives quite an erroneous idea of its relationship. It belongs to an order rare in Australia, but which provides the greatest part of the forest of the Northern Hemisphere. Beech, Oak, Walnut, Willow, Poplar, and many other genera of trees are its relatives.

Our common Beech is a medium-sized tree, with ever-green foliage. The leaves are dark-green, thick, about half an inch long, roughly triangular, and marked on the margin with few coarse serrations. The flowers are obscure, and not often observed. Stamens and pistils, as in all the order, are in separate flowers. The staminate flowers are formed close in the axils of the leaves towards the ends of the branches. There are generally a few together; each has a small six-lobed cup-like perianth, and about eight pendulous stamens. The pistillate flowers are also small, axillary, and near the ends of the branches. Three minute flowers are formed within many bracts, the four inner of which enlarge and enclose the fruits, which are small, flat, or three-winged membranous nuts.

A parasitic fungus is often found growing upon the branches, which it causes to grow into knobs. It is about the size of a pigeon's egg, is apricot-coloured, and marked all over by pits. It is edible, but tasteless.

In Fuegia there are Beeches closely allied to ours, and, strange to say, they also have parasites very like but distinct from ours.

We have a second Beech which is confined to the mountains of the western half of Tasmania. It has generally the habit of a very spreading wiry bush. It sheds its leaves in winter, which is an interesting fact, as it is the only native that does so. Some of the Beeches of Fuegia also do this. Those of the Northern Hemisphere always have this habit. The leaves are of a rather pale blue-green, and are deeply sulcate on the surface. The flowers and fruit do not differ in any material way from those of our common Beech.

Beeches very similar to ours are found in New Zealand and Fuegia. No members of the genus are found in the tropics or warmer temperate zones. This and a similar distribution of many other plants lends some weight to

the idea of recent land connections along the intervening space.

Beech, like Sheoke, is fertilised by the accidental blowing of pollen on to the stigma. In order to ensure this a relatively enormous amount of pollen has to be formed. This is not economical; it appears, when compared with many simple cases of insect fertilisation, to be a prodigal waste. Yet in many cases of the latter, as, for instance, in Silver Wattle, the same prodigality is exhibited. All the earlier types of flowering plants are wind-fertilised. Adaptation to gain the assistance of honey-loving animals seems more recent, though not necessarily very modern. We must always remember that the records preserved in rocks, and translated by students of fossils, are few, and their study is quite a young science; wherefore we must yet wait patiently, and not be in a hurry to come to conclusions about the little information already dug out. In the past geologists have been so anxious to fix incomplete specimens with names, that much error has been committed. A great many forms claimed as ferns that exist in the coal measures are now known, or suspected, to be more nearly related to seed plants. It is very difficult to resist the temptation to describe new forms and explain matters according to what appears to us to be probable; but when information is meagre, the chance of being wrong is much greater than the chance of being right. Hasty conclusions are responsible for many opinions and theories that are not easily unlearned.

On the other hand too great caution will only retard advance. The great strides in knowledge which the human mind has made in recent times is in no form more marked than in the reform or abandonment of the theories upon which we had hitherto based our conclusions. Yet, if we had not held tentative but erroneous theories, we should not have advanced to our present condition. If we did not hold opinions till there was undeniable proof of their exactness, we should not hold any opinions at all.

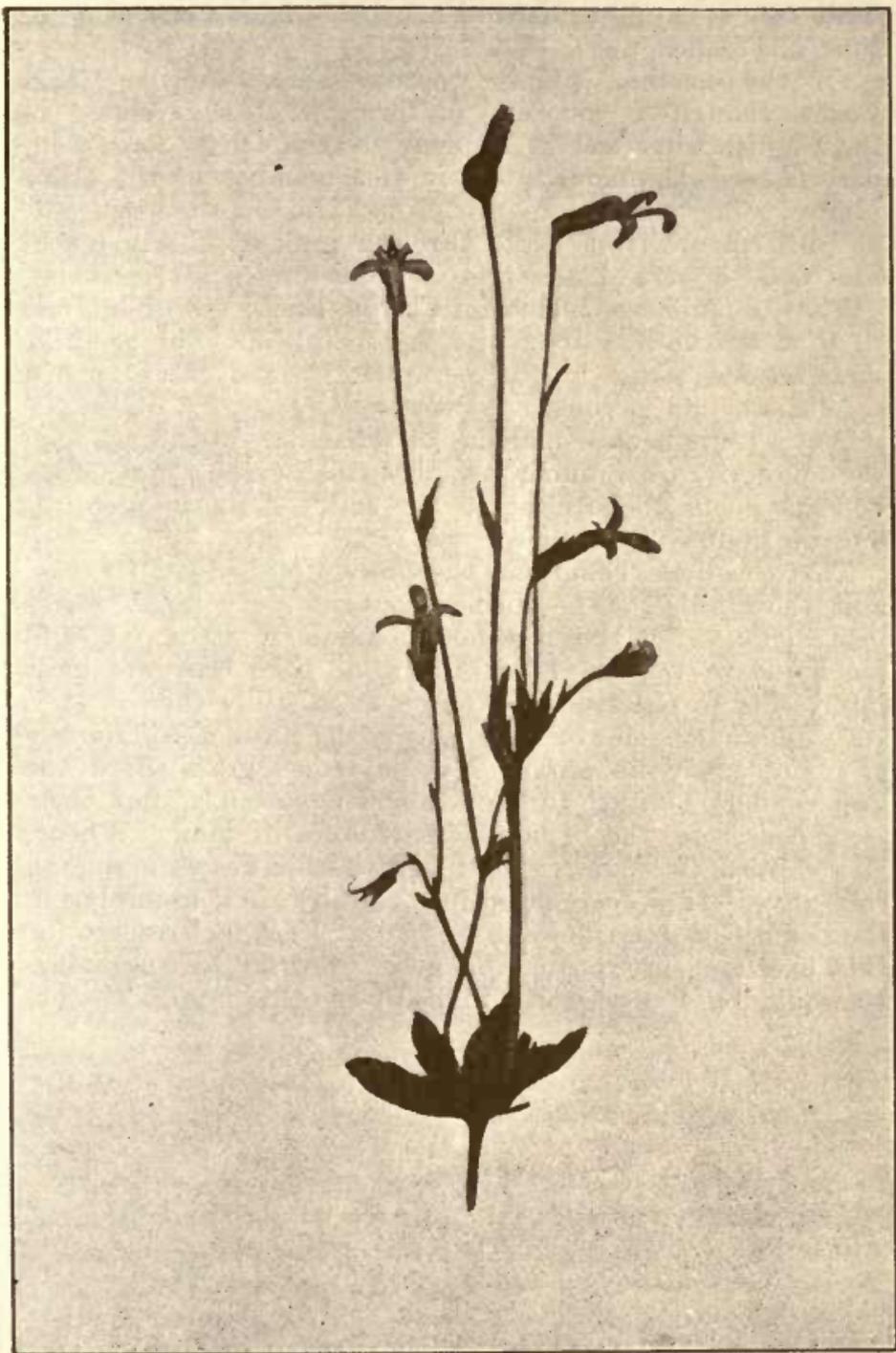
The fossil remains of plants are being subjected to a steady revision. It is not only the carboniferous flora that is being reorganised, but the more recent species founded on leaf-impressions have to be considered. We have credited old Tasmania with possessing a copious flora of Oaks, Willows, Elms, and other trees on the evidence of leaf-impressions; it is very possible we shall have to modify this view.

Chapter XV.

LOPSIDED FLOWERS AND SOME OTHERS.

A stranger who knows something of flowers is generally struck with the number of shrubs and herbs in our bush, whose flowers are so irregular that they may be called lopsided. Perhaps the most interesting of these is the herb we call Trigger-plant, also Jack-in-the-box. It is a conspicuous plant, with numerous pretty pink flowers arranged on an upright stem. The flowers are very peculiar; the stamens and pistil are united in a bent column; the anthers ripen first; the column is bent back like a trigger; now, if a fly settles at the base of the column, looking for honey, the trigger suddenly springs forward, so as to bring the anthers on to the fly's back. The insect in endeavouring to escape gets its back covered with pollen. The fly next visits an older flower, and here the anthers are shrivelled up, and between them the ripe stigma protrudes. The same spring occurs again, but now the stigma is rubbed on the insect's back which is already covered with pollen, and thus cross-fertilisation is effected.

Parrot's-food and its allies are very one-sided, and except in some small white-flowered species, and two which are blue, are always yellow. The flowers have no trigger, but crossing is effected in a somewhat similar manner; the anthers mature before the flower opens; the style is in the form of a brush that is a stalk and the brush at the top. This brush is two-lipped, and each lip is furnished with bristles. The stigma, shaped like a cushion, pushes its way out between the lips which bend back, and the bristles prevent the pollen of the same flower from fertilising it. We have many *Lobelias* which are similarly constructed, except they have not a brush-termination to the style. *Eyebright* is a pretty perennial, with irregular flowers of varied colours, white, yellow, or blue, which should repay cultivation in our gardens. *Veronica* is closely allied to *Eyebright*. They are also called *Speedwell*. The nearly regular flowers are blue, with a four-lobed corolla, combined in a short tube, and bearing only two stamens. The last of the lop-sides we will note is that pretty shrub commonly called *Tasmanian Christmas Bush*, likewise *Native Lilac* or *Mint-tree*. It



LOBELIA RHOMBIFOLIA, De Vr.

[See p. 94

really belongs to the Mint family, that is the Labiates. This can always be identified by the fruit consisting of four one-seeded nuts.

Of the common plants we may here refer to Heart Berry, though so different in form, is closely related to the English Lime-tree or Linden. Native Olive, for a wonder, is correctly named, for it is a member of the Olive family. The berries are numerous, and semi-transparent, and all colours from white through pink to nearly black. The wood is very dense, and is often known as Ironwood.

The Toughbarks, including Cotton Bush, are of interest in that the flowers are white and petal-like, but as there is only one series in the perianth it is a calyx, not a corolla, though it looks very like one.

Ant's Delight is a small heath lying flat on the ground; the flowers are numerous, brownish-green, and open beneath so as to be close to the soil. Ants frequent it, and no doubt are the means of fertilising.

There is little beauty in the flowers of Sedges, Grasses, and their allies. The former contains very many forms in Tasmania, but they are not particularly attractive, and too harsh to be useful; at the same time they are most interesting to the student who cares to study them. It is very different with grasses. This is the most useful family of plants upon the earth. Not only does grass afford the greater part of food for our domestic animals, but their seeds constitute the principal sustenance of man. Wheat, Rice, Maize, Oats, Barley, Millet, together keep the human race alive. If we cannot go into raptures in contemplating the beauty of grass flowers, we can at least feel respect for this excellent group for the good they do to humanity. It would be a poor world indeed were this family absent.

Chapter XVI.

LILY AND IRIS.

We have used the name "flowering plant" in a restricted sense to save us using a scientific word. We mean by it all those seed-bearing plants that do not belong to the Coniferous or Pine family. They are not the only plants possessing flowers, but they are the only ones that bear the conspicuous forms that in ordinary talk are called flowers.

This large group is formed of two well-marked and quite distinct sections. All forms hitherto treated belong to the Dicotyls; the subjects of this and the next chapter belong to the Monocotyls. It is not easy to define the difference between the two. If you germinate a seed of the first, such as Eucalypt, Cabbage, Pea, it may be seen that a pair of leaves first show above the ground; these leaves are very apparent in the seed; they are called cotyls, so the section gets its name from this fact. Amongst the other plants no such regularity appears. The leaves appear in succession, and it is rather an assumption that they possess one cotyl. The practical way of distinguishing is by examination of the parts. In Dicotyls the leaves have generally netted veins, and the parts of the flower in fours or fives. In Monocotyls the veins are usually parallel, and the parts of the flower in threes or sixes. No rigid rule, however, is apparent, but with a little experience there is no difficulty in correctly placing a plant.

Palms, Orchids, Lilies, Sedges, Grasses, and such are Monocotyls. Of these, some have conspicuous flowers; others, like Grass and Sedge, obscure ones; but all tend to the one type, which may be best understood by examining a Lily.

The Lily family is a large one, and found throughout all habitable portions of the globe. It is a well-marked group, though it passes without break into the Rushes. Blackboy, also called Grasstree—a name apt to confuse it with the other Grasstree, Richea—is on the border of the two, being placed by some in one family, by others in the other, and with equal justice. In a typical Lily there is no doubt. In Rush the perianth is greenish, hard, and obscure; in Lily it is delicate, and coloured or white. We have eighteen Lily genera, but most are not often met with.

There is considerable difference in their perianths, which may be made up of separate parts, or may be variously combined; but it is always attached below the ovary. The stamens vary in structure, and these differences, often slight, are made use of in classifying them. There is also difference in pistil and fruit.

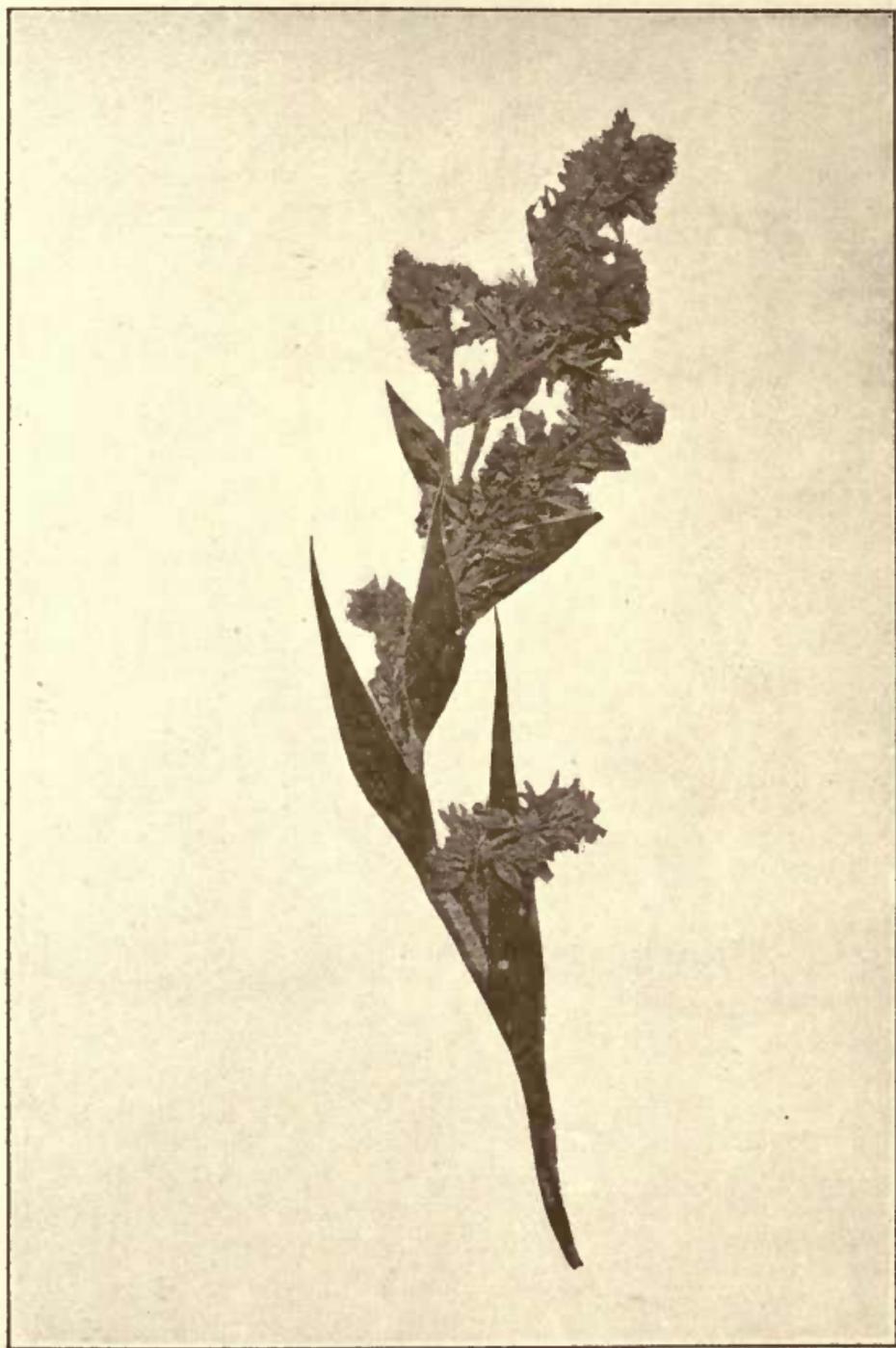
Dianella is our commonest form, and is found in all parts. It grows in a tuft with long narrow leaves, which are often recurved on the margin. The flowers are numerous, in erect, spreading inflorescences. They are always blue, and generally dark. The fruit is a small dark-blue berry. The perianth is formed of six nearly equal parts, that are but slightly united to one another at the base. They are in two circles, each of three parts, and may be called calyx and corolla if you wish. They are longitudinally lined in the centre with three to seven parallel lines. After flowering the perianth gradually withers and falls off. There is no good popular name. *Sword Lily* is also used for other plants; *Blueberry* confuses it with *Blue Climbing Berry*. The stamens are very interesting; there are six, and their anthers are long and usually discharge the pollen through a terminal pore. The filaments have a peculiar thickening that commences close under the anther and extends a longer or shorter distance, according to the species.

Stypandra is a small densely-tufted plant, with grassy leaves, common in heathy places. The flowers are few or many, and arranged about the same level; usually pale-yellow, sometimes blue. The perianth is very much as in *Dianella*, but twists round the fruit after flowering. The anthers are small, and coil backwards after flowering. The filaments are long, slender, flexed, and covered with minute papillæ. The fruit is fleshy.

Gordon River Lily belongs to the genus *Milligania*. It grows in the water of some western rivers. The leaves are long, narrow, and flat, and the flowers are cream-coloured and numerous, in spreading masses, growing on a tall stalk. A second species of the genus is found on the mountain plateaux, from *Mt. Hartz* to the west.

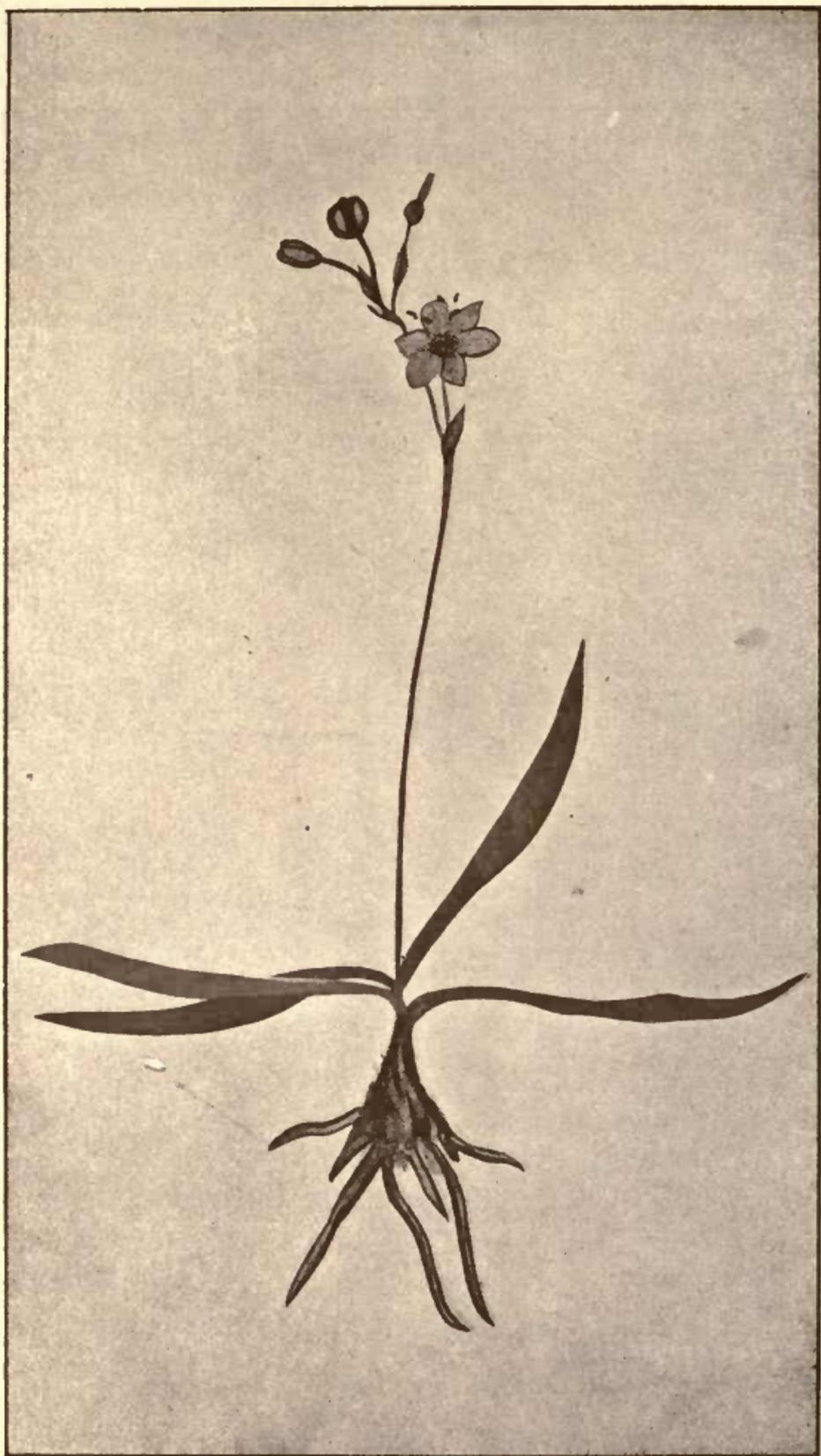
Blandfordia is a very showy plant. The perianth is an inch long, crimson, tipped with yellow; it is tubular, gradually expanding, with six lobes at the end. There are numerous flowers arranged along on erect stalk.

Rock Lily grows in grass as well as upon almost bare stone. It is very like an onion in form of leaf, but the numerous flowers are yellow and arranged along a tall



MILLIGANIA DENSIFLORA, Hook.

[See p. 98.]



BLUE VERNAL.

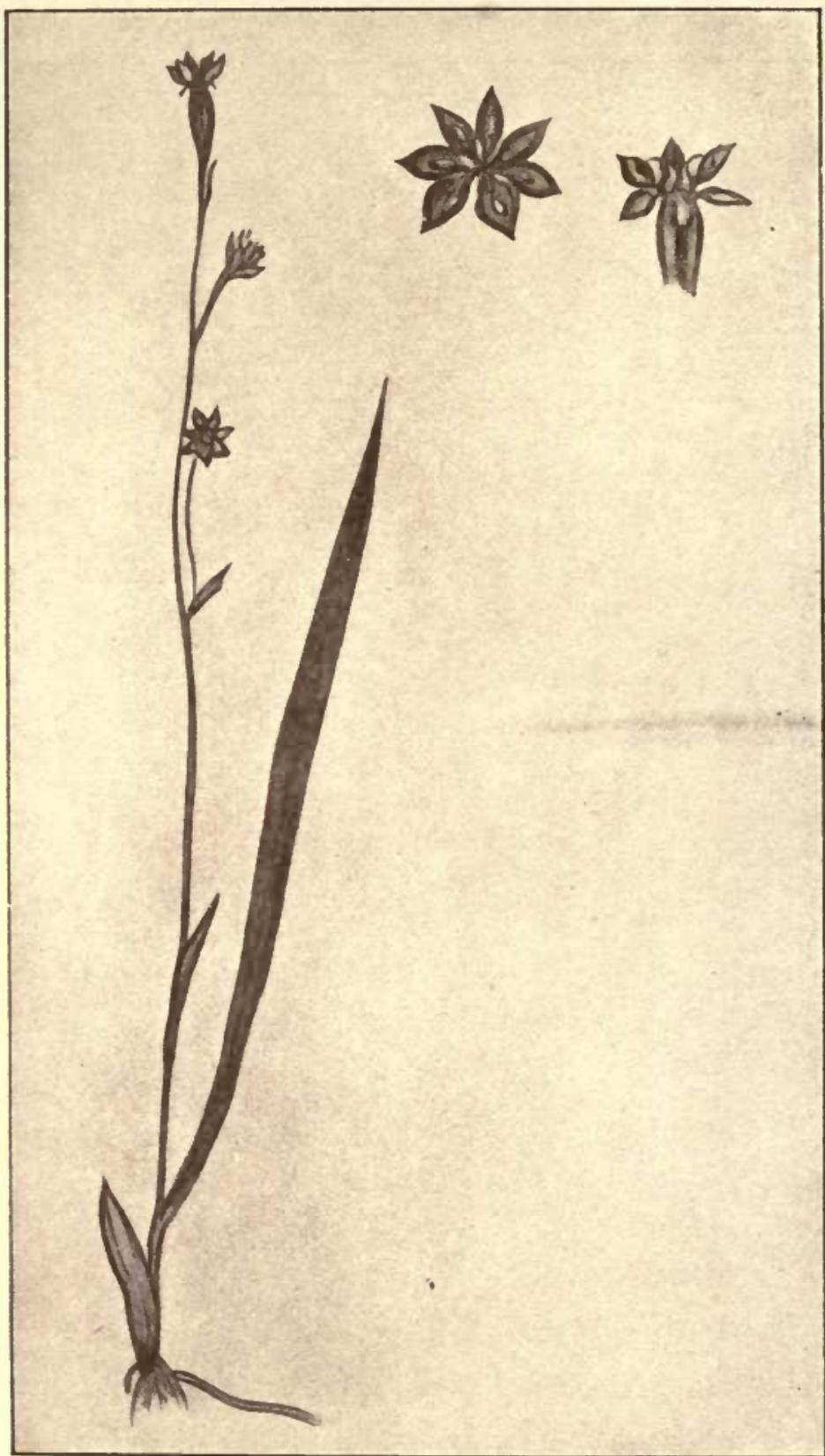
(*Chaemiscilla corymbosa*, F. v. M.)

[See p. 98



WHITE FLAG.
(*Diplarrhena moroëu*, Lab.)

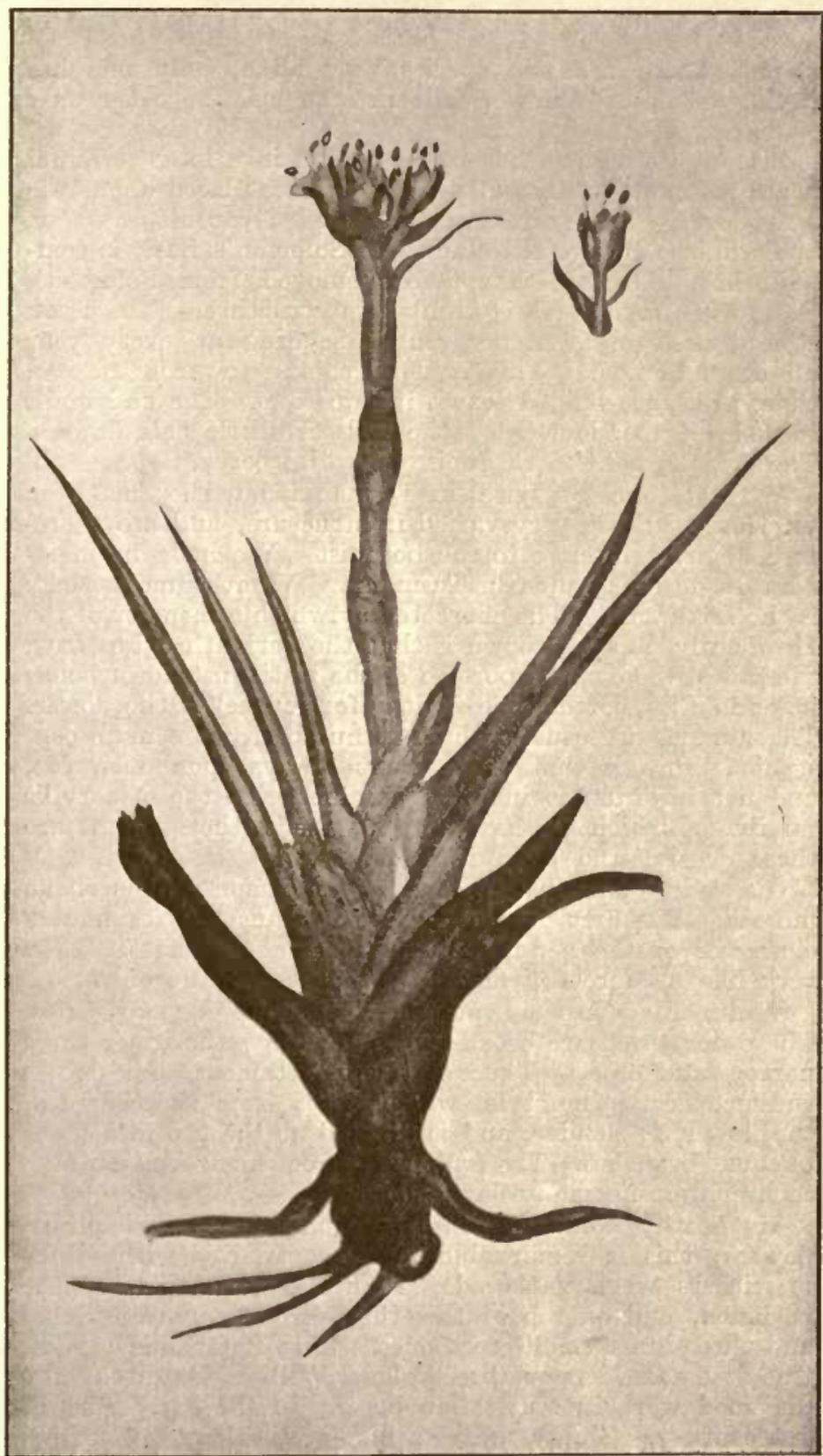
[See p 104



CAMPYNEMA.

(*Campynema lineare*, Lab.)

[See p. 106



SCARLET PORCUPINE.

(*Haemodorum distichophyllum*, J.D.H.)

[See p. 106

stem. There are two species very alike, only one has a ring of fleshy hairs on all six stamens, the other only on three of them.

Star of Bethlehem has white flowers in a loose terminal head, so arranged that all the flowers are placed about the same level. The fruit is a three-angled capsule.

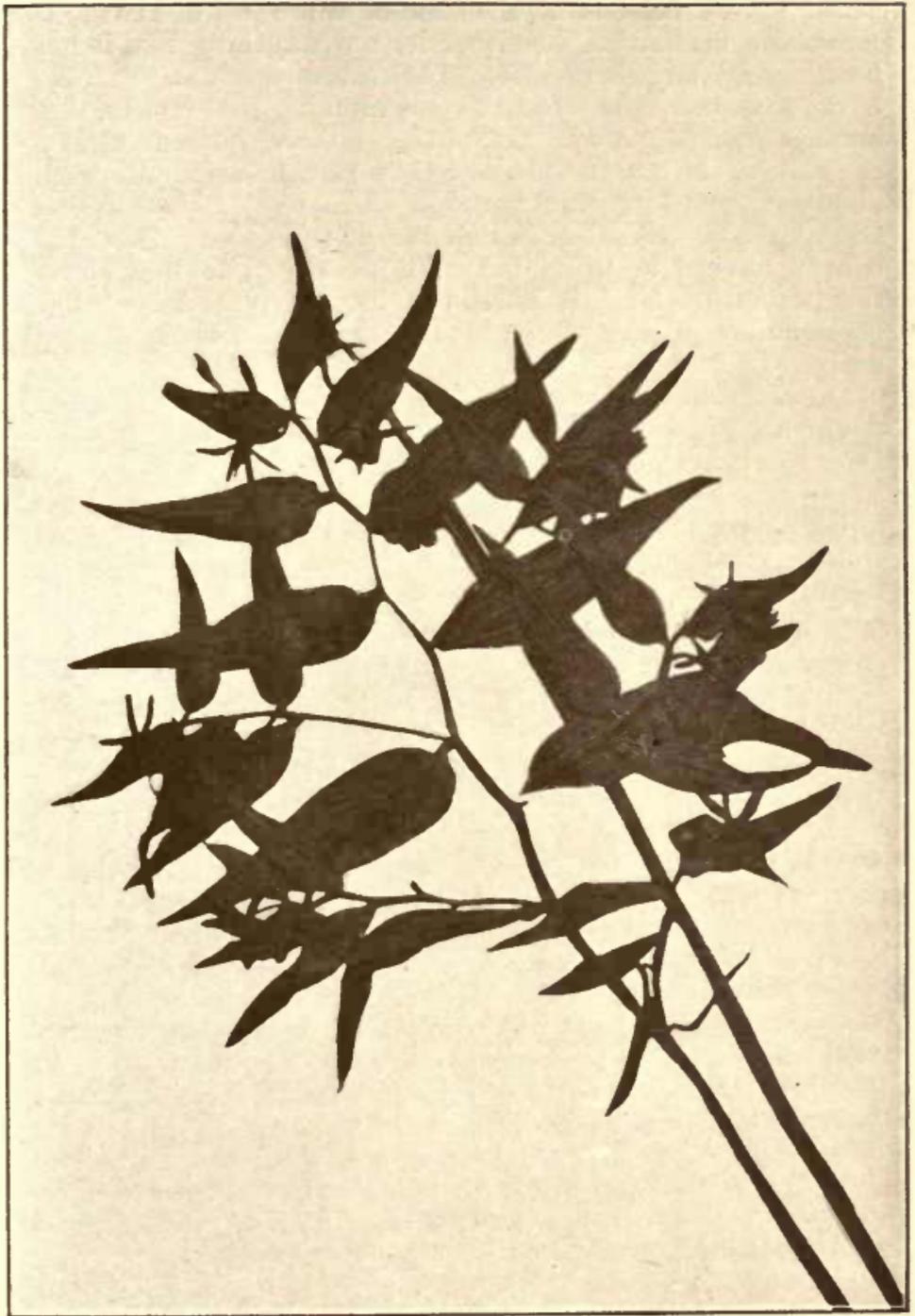
Turquoise Berry, also known as Solomon's Seal, is common in woods. It is not far removed from Solomon's Seal of Europe, and is similar in structure. The main stem travels along underground, sending up every year an erect branch. This is slender, and towards the end there are lance-shaped leaves in two rows. The end tends to nod, and pendent below the axils are little pale flowers. The fruit is a little turquoise or white berry.

We have but few Irises in Tasmania, but they make up for that by being very varied in structure, and are therefore of great interest to the botanist. We have no members of the *Iris* genus in Tasmania. What is meant here is the *Iris* family. The character by which a member of the *Iris* family may be known is that the perianth arises from the top of the ovarian portion of the pistil instead of below it, as in Lily, so that the fruit is formed below the flower. The stamens are usually three in number, but a more constant feature is that the anthers always open outwards, and not inwards, as in allied families. In the *Amaryllis* family, of which we have few members, the stamens are three or six, and open inwards.

Our White Flag has a horribly long name, *Diplarrhena moroea*. The first or generic name means two stamens, a character of the genus; and *moroea* means that it looks very like a *Moroea*, which is a South African genus.

White Flag has six perianth segments in two series. The outer three are broad and spreading; the inner three narrow and erect. There are three stamens, but one is rudimentary. The style, which arises from the centre of the flower, is slender, and is divided at the top into three unequal branches. The fruit is a three-chambered capsule, each containing many flat seeds.

In heathy country we often find an *Iris* with blue flowers; this is remarkable for the rapidity with which it withers when gathered. It has a long tube to the perianth, and on top of this three broad spreading lobes and three inner small erect ones. It is *Patersonia glauca*. The first name immortalises Colonel William Paterson, who did good work in Australian botany in the early part of last century. *Glauca* means a blue-grey colour.



TURQUOISE BERRY.
(*Drymophila cyanocarpa*, R. Br.)

[See p. 104

On some of the mountains of south-west Tasmania there grows a very interesting member of this family, known as *Hewardia tasmanica*. Neither it, nor anything like it has been found anywhere else. The leaves are flat, narrow, 3 or 4 inches long, and, as common to the family, are arranged in two rows. The flower is dark purplish-brown or yellow, of six nearly equal perianth divisions, each about an inch long, and reflexed when fully open. It has the typically three outward opening stamens, but the ovary, instead of being below, is nearly quite free above the perianth. This is a remarkable survival or peculiar reversion, but does not warrant the plant being placed amongst Lilies.

It was common once to style the Dicotyls the higher flowering plants, and Monocotyls the lower, and to consider the latter as primitive in time as well as in structure. There is no warrant for this. They are two parallel lines quite independent of one another, that probably diverged from a common ancestor, but how and when we have no record. There is no reason to suppose that Dicotyls have been derived from the other; on the contrary, there are some points that might lead us to conclude that the Monocotyls are the more recent, and a reduced offshoot from the Dicotyls.

Chapter XVII.

THE ORCHID FAMILY.

This family is the wonder and admiration of all who take an interest in flowers. It attains its finest development in the tropics, where the common habit is to grow on the trunks and branches of trees, often far from the ground. It is also universal in temperate regions, but there the habit is generally to grow on the ground and produce flowers, which, though too small to attract attention from the gardener, are yet of singular beauty.

The flowers of Orchids have usually some singular shape that appeals at once to lovers of the curious. But not always so; occasionally they have the same regular form we are familiar with in other groups. The most noticeable feature by which they can be known is that the stamens and style are intimately blended to form a column in the centre or to one side of the flower. Amongst Monocotyls this condition we will only find in this family, but the same arrangement will be found amongst Dicotyls in our common Trigger Plant.

The ovary is placed below the flower; it consists of three carpels with a common ovarian chamber, with three lines of minute seeds placed in three lines on the walls. The perianth is normally formed of six parts, but these are often so much changed from simplicity that they are not always apparent. The peculiar structures produced in the perianth are modifications to ensure cross-fertilisation by insects. To assist this the pollen has an interesting feature: instead of being like free dust, it remains in an adherent mass, at one end of which there is a club with a sticky disc. When a fly or bee visits the flower the disc adheres to its back or head; it then flies away, carrying the pollen mass as a plume hanging over its head. Visiting another flower the pollen is rubbed on the stigma and a portion or all of it is left there.

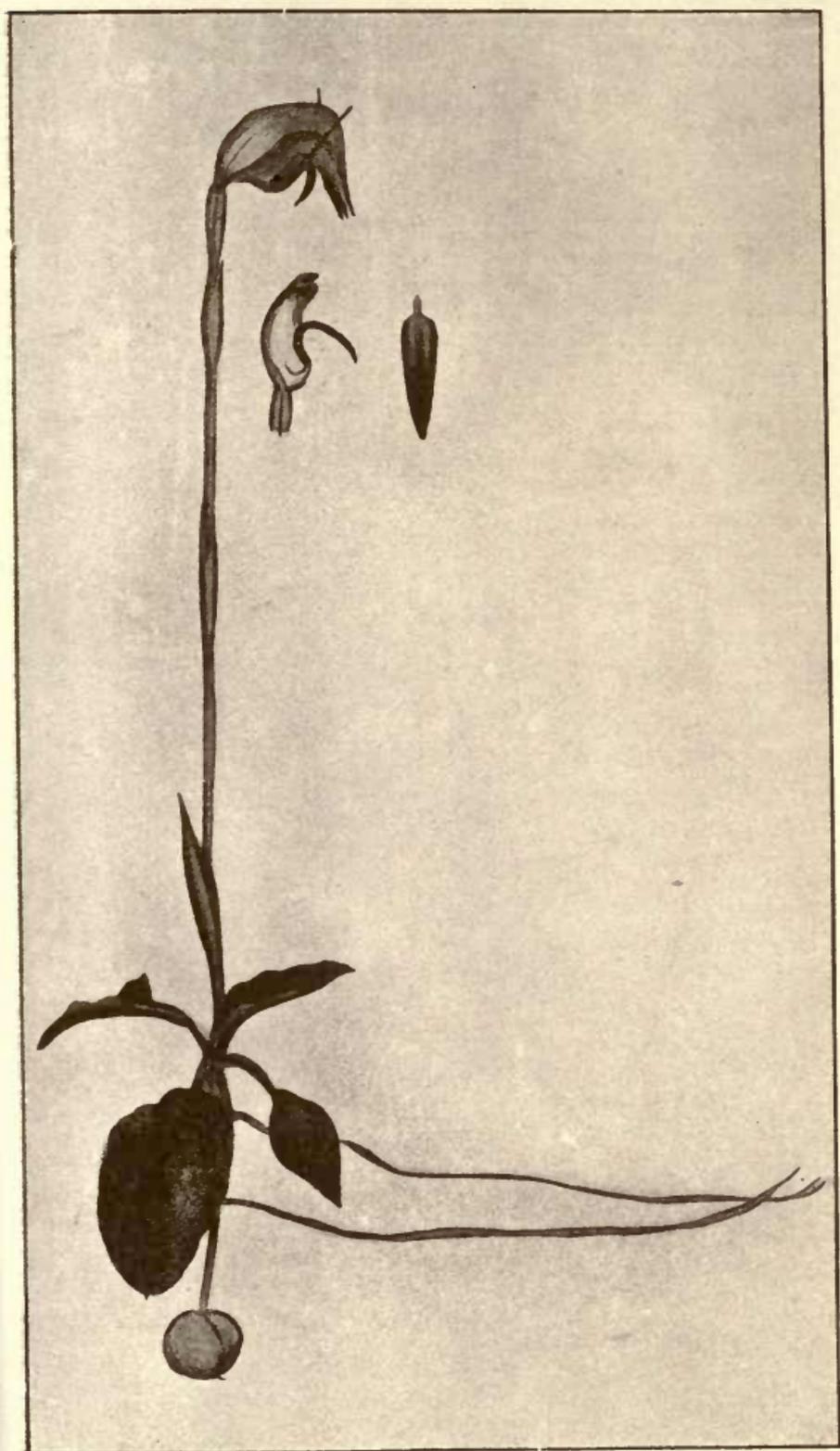
We have twenty-three genera and about eighty species, many of which are very common. We will describe some and briefly refer to others.

One of our commonest genera is *Pterostylis*, meaning winged style, so named because towards the top of the column there are two delicate wings that converge towards their ends, forming a tube for an insect to travel up



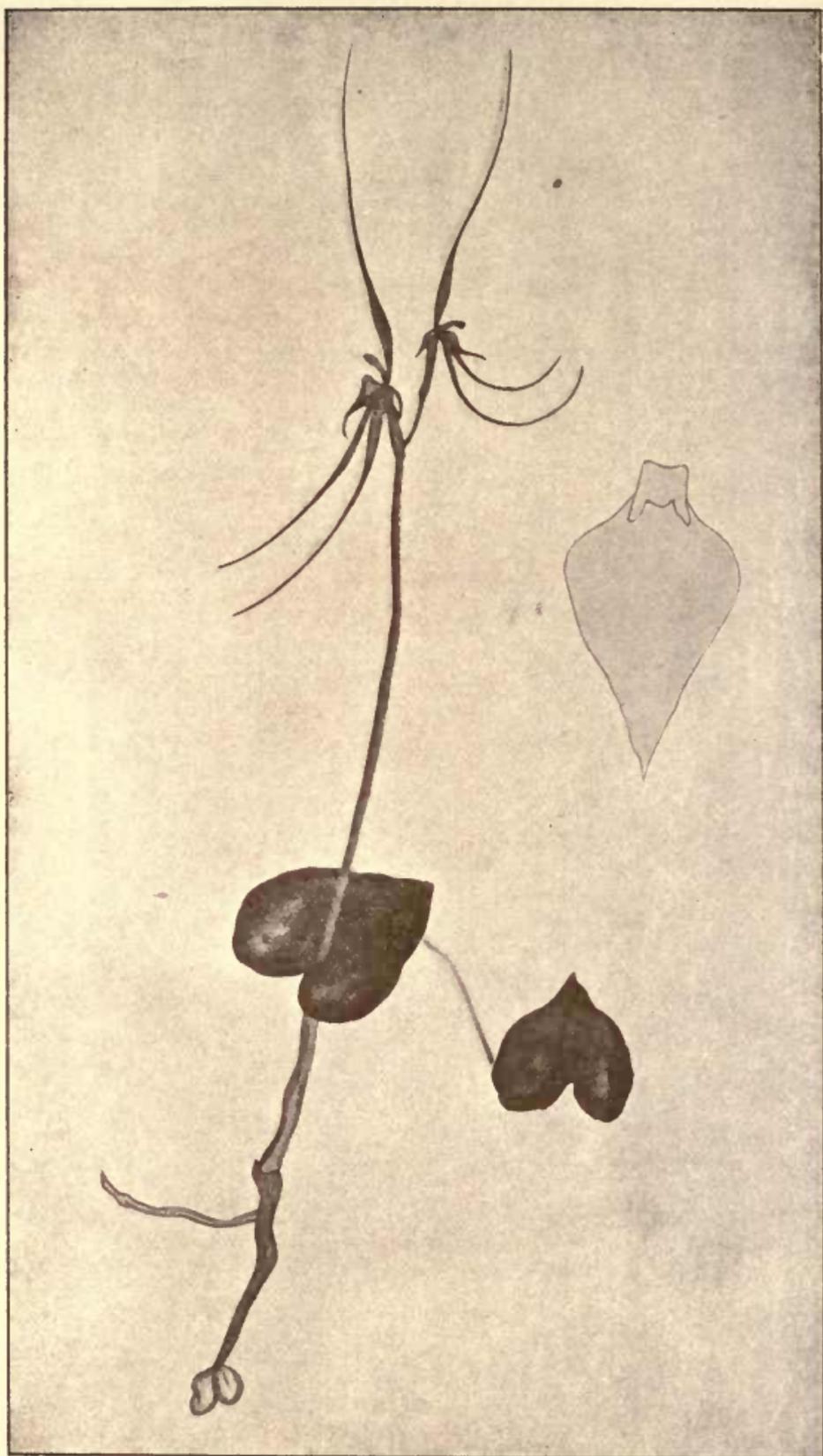
HEWARDIA TASMANICA, Hook.

[See p. 106-



COW HORNS
(*Pterostylis nutans*, R. Br.)

[See p. 112



LITTLE SPIDER.
(*Acianthus caudatus*, R. Br.)

[See p. 112.]



BLUE FIELD ORCHID.
(*Caladenia deformis*, R. Br.)

[See p. 112

through. There are many species, called Green Hood, Helmet, Cow Horns, &c., all formed on one type.

Cow Horns is very common in the spring. The flowers are solitary and nodding at the end of slender stalks. Green and brown and rather flattened laterally, it is made up of six segments of two series of three each, which it will be convenient to call calyx and corolla. It appears to be formed of two parts, an upper hood and a lower erect portion. The hood consists of one sepal and two petals, not united but adherent. The lower piece consists of two sepals which have slender terminations and rise up on each side of the hood. The third petal is a very peculiar structure, and as it is greatly altered from a petaloid form in Orchids, it is called the labellum. Labellum means lip. In *Pterostylis* it looks more like a tongue, which varies slightly in shape in different species. In Cow Horns the labellum is long, slender, dark, nearly erect, the acute tip protruding through the division between the two lower sepals. It is supported upon a flat curved stalk, and from its base arises a small curved lobe tipped with an irregular brush.

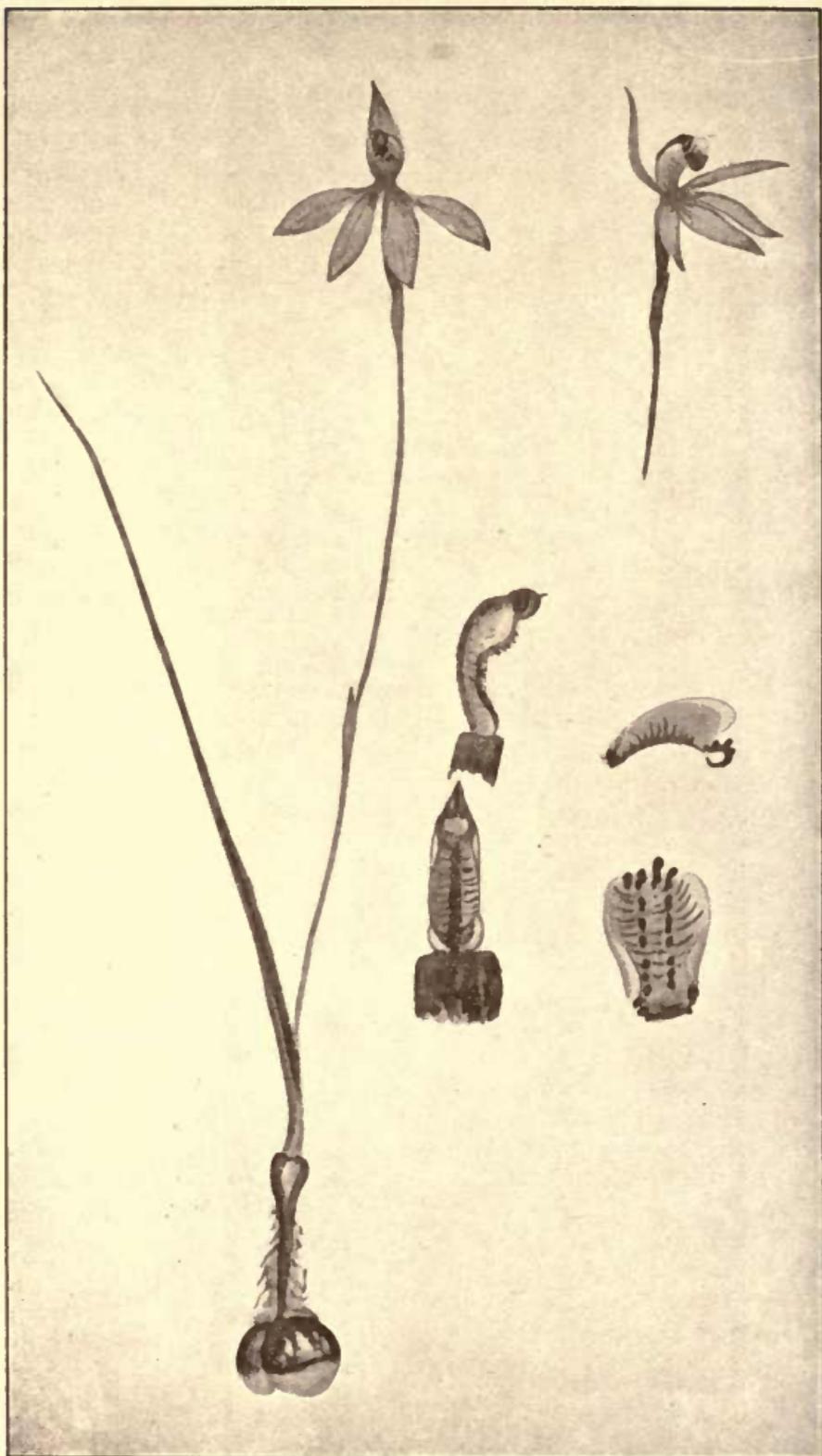
The column is bent to accommodate itself to its position within the hood, and has on its anterior surface a fleshy stigma, and close above at the apex are two anthers containing pollen masses; along the upper third are the two delicate wings already alluded to. A fly attracted to this flower enters through the opening between the perianth segments, and alights upon the tip of the labellum, down which it walks towards the stigma. As soon as it touches the brush, by a peculiar faculty the labellum moves, placing itself close against the opening between the wings, where it remains for some time. The fly then proceeds to escape. The way it entered is shut off by the new position assumed by the irritable labellum; it therefore proceeds up the column between the wings, comes in contact with the anthers, the discs adhering to it, and flies away with pollen masses attached. Being a greedy animal, it enters another flower, and exits in a similar manner, only in passing the stigma it rubs the pollen on the sticky surface. As the fly always goes the easiest way, the pollen is never placed on the stigma of its own flower. We have many species of *Pterostylis*, but the flowers all conform to this type.

Spider and Pink Orchid are dissimilar flowers of one genus, *Caladenia*. The perianth segments in Spider are very long; in Pink Orchid they are short. The three sepals



COMMON SPIDER ORCHID.
(*Caladenia patersoni*, R. Br.)

[See p. 112



PINK ORCHID.
(*Caladenia carnea*, R. Br.)

[See p. 112



NATIVE HYACINTH.
(*Thelymitra izioides*, R. Br.)

[See p. 116

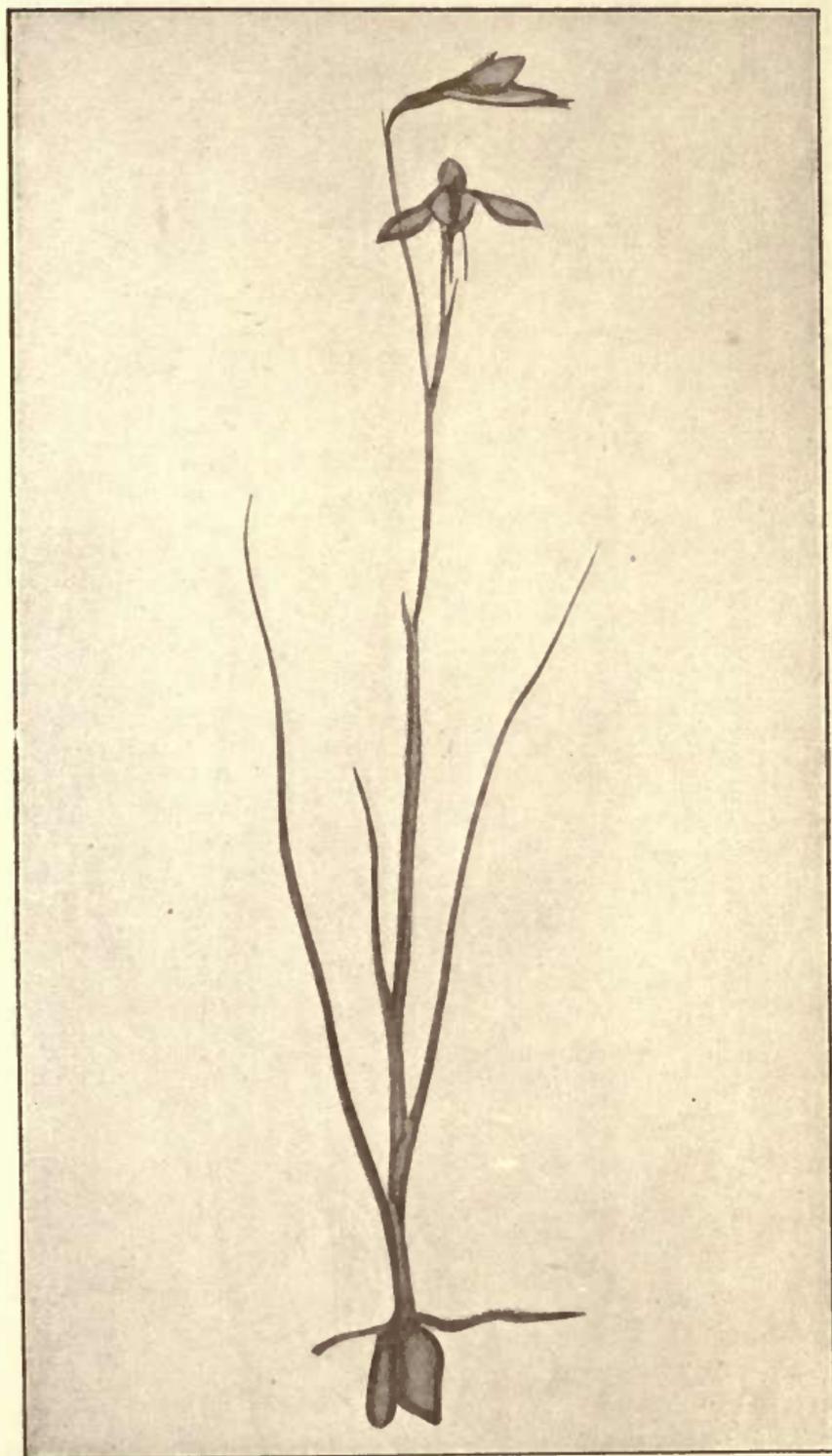
and two petals are free, and more or less spreading. The labellum is broad and concave from side to side, convex in the long direction, where it tapers to a point; the surface and sides are variously clothed with papillæ. It is mounted on an irritable stalk, and the column is formed also very much as in *Pterostylis*.

Another common genus is *Thelymitra*, which has such regular flowers that the common form is often called Native Hyacinth. This is a handsome plant, sometimes 2 feet high, with numerous rather large flowers, blue, pink, yellow, or white, often spotted. All six segments of the perianth are about equal, and spreading. The column is short, with the nectary, stigma, and anthers close above one another. It has a wing running down each side, at the upper end of which arises a lobe terminating in a brush, club, or other adornment, according to species.

Parson-in-the-Pulpit is a pretty little spring flower. It has a solitary or sometimes two blooms on a slender stalk, of a pretty mauve or paler shade, about an inch across. Three sepals and two petals are similar and spreading. The labellum is short and convex, and from its base there is a little erect, usually yellow, lobe, which gives its name to the flower. The column is the same in structure as in *Caladenia*.

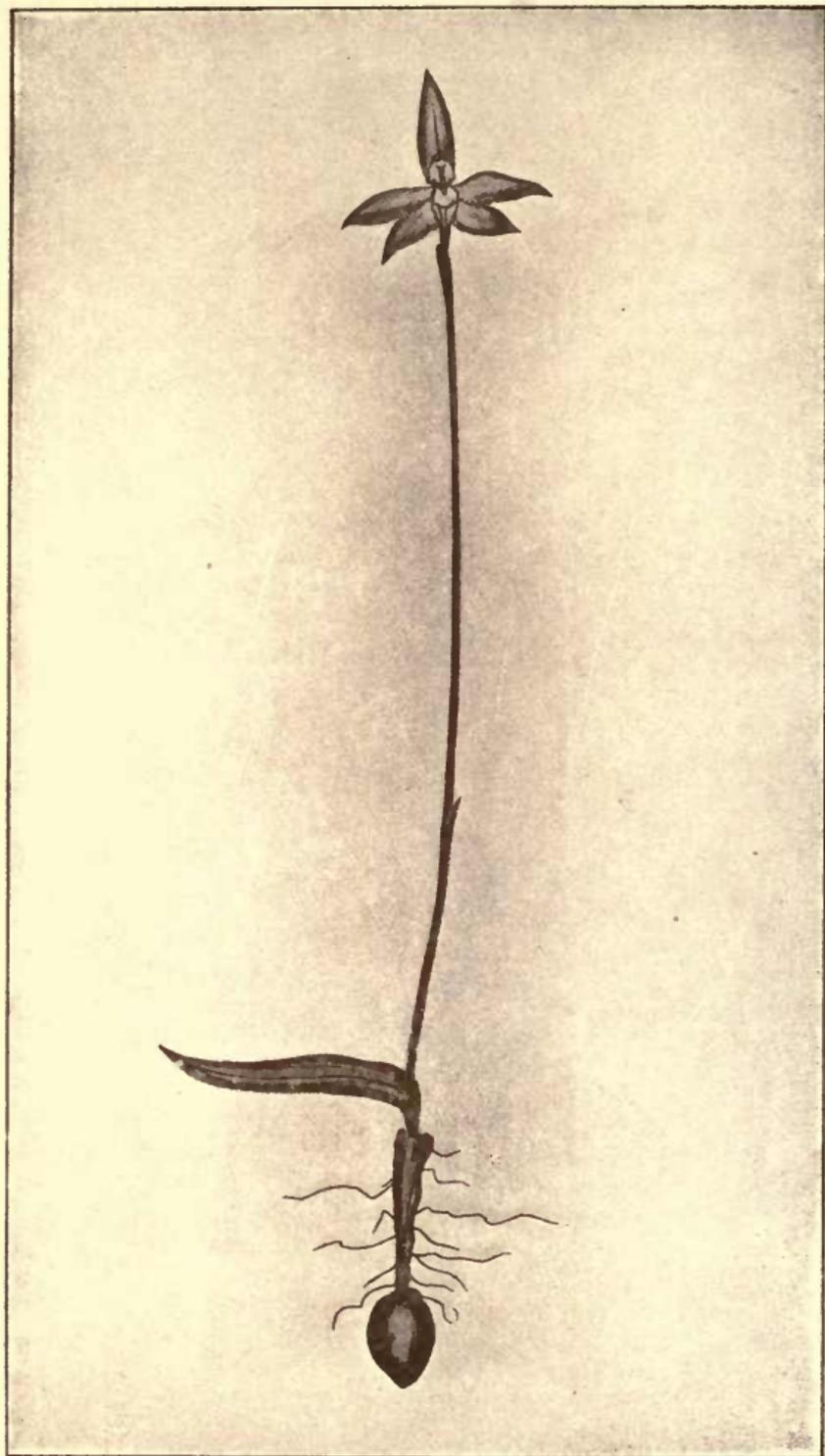
The Tigers are common in spring and summer. They are yellow, generally blotched with reddish-brown. The flowers are fairly large, and generally there are many on an erect stem. They are very irregular. The upper sepal is broad, and over-arches the column; the lower ones are long and narrow. The lateral petals are broad and spreading; the third petal or labellum is broad, rather short, and three-lobed. The column is very short, and bears a lobelike wing on each side. The genus is *Diuris*, and we have five species, four of which are very similar, but the fifth would be taken for a different genus. It is *Diuris pedunculata*, common in grassy woods. It bears one to three pale or orange-yellow flowers, the segments of which are all directed forwards.

Fly Orchids are also common. They are so named because there are numerous small, sometimes very small, flowers massed along the upper part of an erect stem. They have no likeness to flies. The perianth segments call for no special comment, but they can be at once distinguished from other similar Orchids by the labellum being above and the column below. This is the normal position, and in those Orchids where the other condition



GOLDEN MOTH.
(*Diuris pedunculata*, R. Br.)

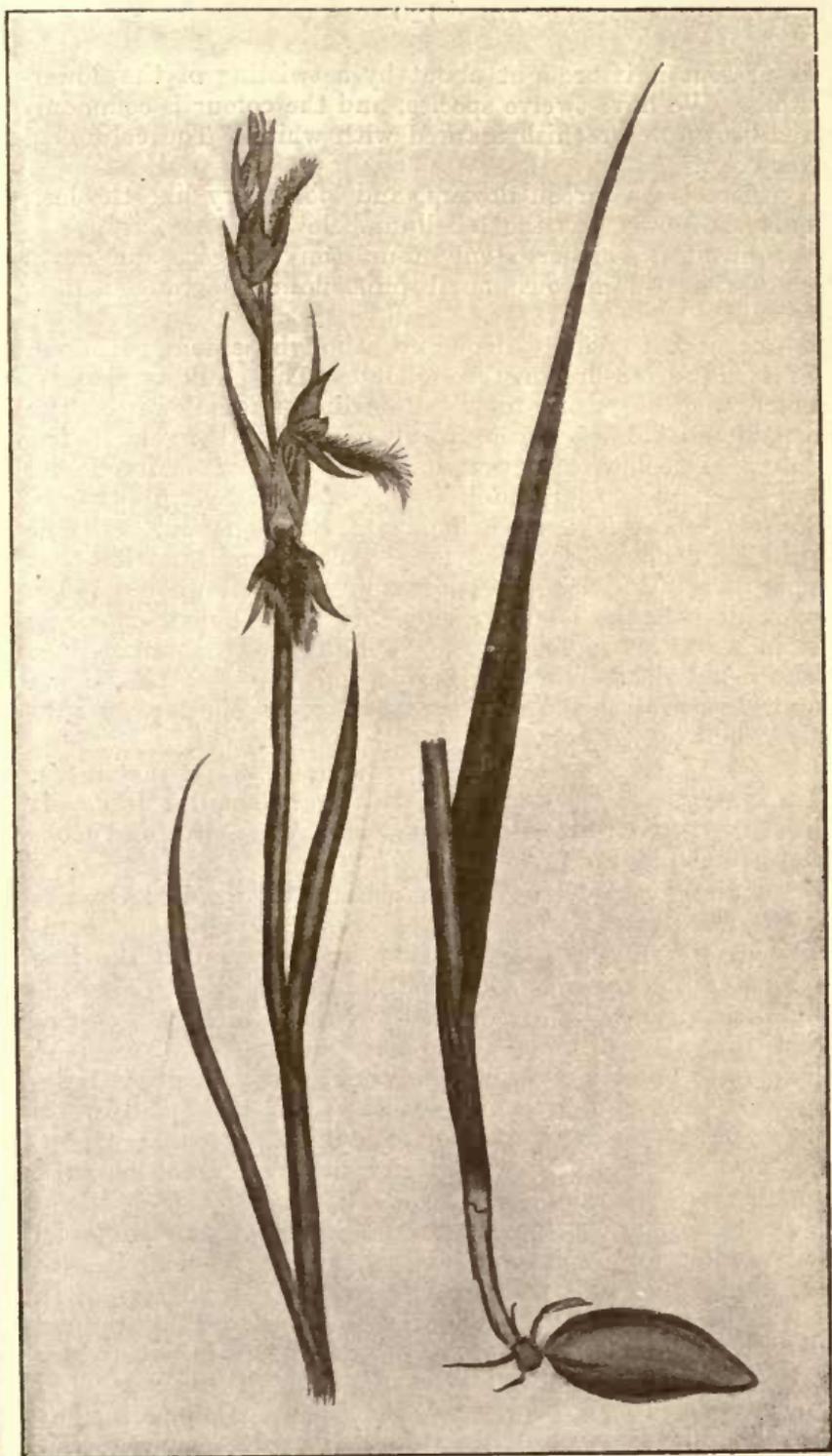
[See p. 116



PARSON-IN-THE-PULPIT.

(*Glossodia major*, R. Br.)

[See p. 116



LONGBEARD.

(*Calochilus campestris*, R. Br.)

[See p. 120

is present it is brought about by a twisting of the flower-stalk. We have twelve species, and the colour is commonly red-brown or greenish marked with white. The column is very short.

Microtis has green flowers, and looks very like the last, only the flower has the labellum below.

Spiranthes, hitherto only found on the east and north coasts, has numerous small pink flowers arranged in a spiral.

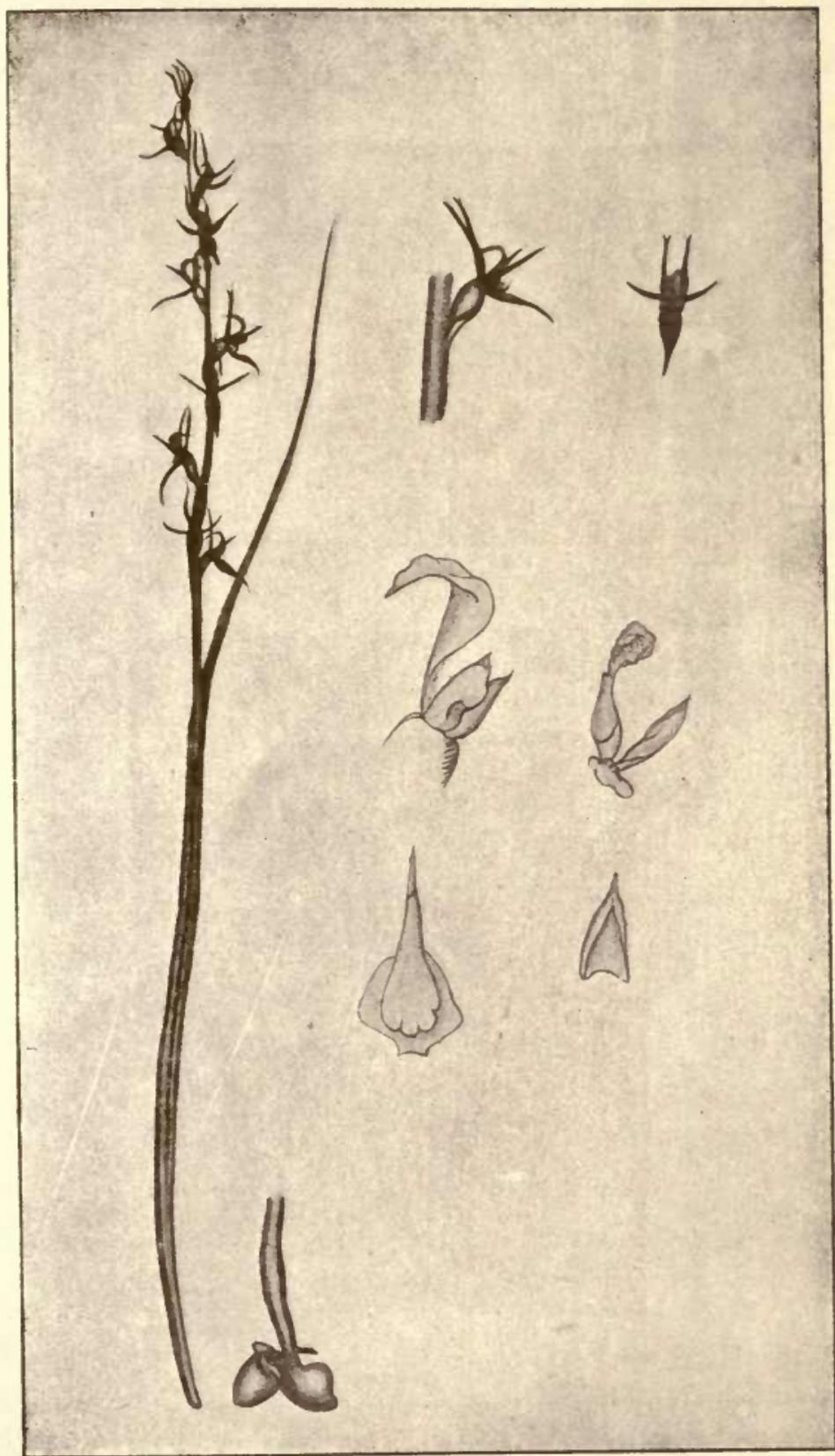
Cockatoo is widely dispersed, though seldom gathered. It is dark red-brown throughout. The stalk is slender, erect, and bears one to three medium-sized flowers. The sepals and pair of petals are all narrow and slender. The column is below, nearly as long as the sepals, curved and bordered by two large delicate, somewhat diverging wings. The labellum is above; it has a strap-shaped, irritable stalk, and a broad convex, nearly black, main portion that appears as an inviting crest for a fly to alight upon. When a fly does so the labellum suddenly shuts down, enclosing it in a box composed of the labellum and column wings. The insect, in its efforts to escape, rubs itself on the stigma and then against the anthers, performing similar work to that done in Cow Horns.

Duck Orchid is occasionally found in swampy country. The flowers are dark-red. With a very small column, it has a very large broad labellum, which is above, and looks something like a duck's bill.

As already said, the common habit of tropical Orchids is to grow upon the branches of trees. They are not parasites, but simply epiphytal; that is, grows upon the tree without deriving nourishment from it.

We have only one epiphytal Orchid, which is occasionally found on the east and north coasts. It has many long roots, closely clasping a branch, a few long flat pale-green leaves, and drooping bunches of pink and white flowers. It is commonly called *Gunnia*, after R. Gunn, the man who did more than any other Tasmanian botanist in the study of our plants.

Of our other Orchids, Ant Orchid has a pair of broad leaves close to the ground, and an irritable labellum with shining glands on its surface, giving it a resemblance to an ant. Longbeard has a long labellum placed above and densely covered with purple hairs. *Eriochilus*, which appears in late summer, is small, without any leaf, and one or two pink flowers, very like a small *Caladenia*, but the labellum is erect, with a fleshy sharply recurved end.



FLY ORCHID.
(*Prasophyllum fuscum*, R. Br.)

[See p. 116



GUNN'S ORCHID.
(*Sarcochilus parviflorus*, Lind.)

[See p. 120



DUCK ORCHID.

(*Cryptostylis longifolia*, R. Br.)

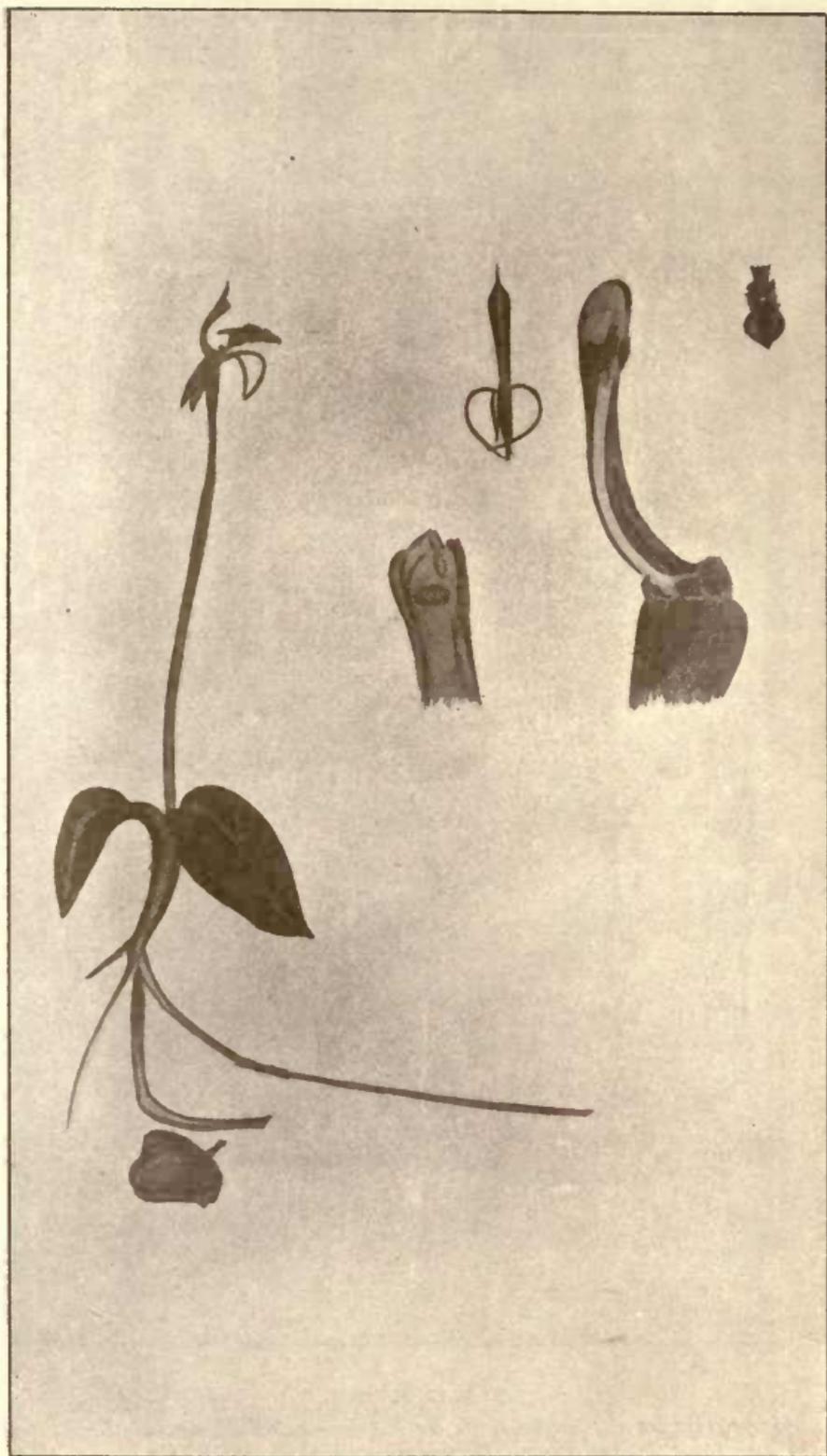
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COCKATOO.

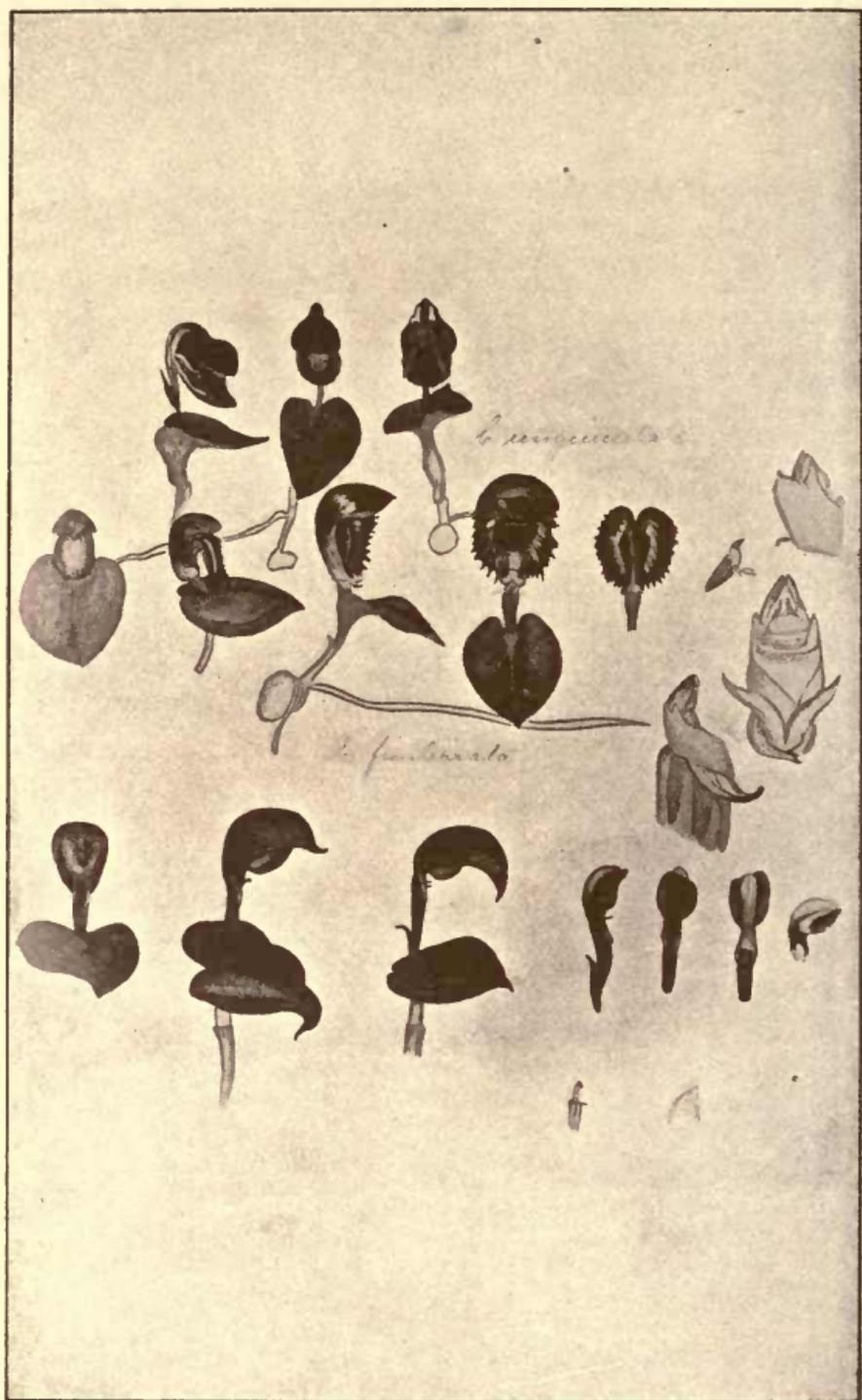
(*Caleana major*, R. Br.)

[See p. 120.]



LESSER ANT ORCHID.
(*Chiloglottis diphylla*, R. Br.)

[See p. 120



LITTLE HOOD.

(*Corysanthes unguiculata*, R. Br. *Corysanthes diemenica*, Lind.
C. pruinosa, Cunn. *Corysanthes bicalcarata*, R. Br.)

[See p. 127]

Corysanthes is only about an inch high. It has a single heart-shaped leaf and a broad hood-like dark-red flower. Pink-spotted Orchid is a fine many-flowered plant, very like a hyacinth. It has no leaves or green tissue. It grows from a bunch of tubers, is dusky, with few or many dusky and white flowers, very constricted at the orifice.

Chapter XVIII.

CARNIVOROUS PLANTS AND PARASITES.

A typical plant, is green in colour, and it is so because it possesses a quantity of a peculiar substance called plant-green, or chlorophyll. This substance contains a minute quantity of magnesium. By means of the energy derived from light, this has the power of decomposing carbonic acid gas, and, after a complicated process, of producing starch or sugar. After this, by further combination with salts received by means of the water absorbed by the roots, all the multifarious compounds required as food by the plant are well built up.

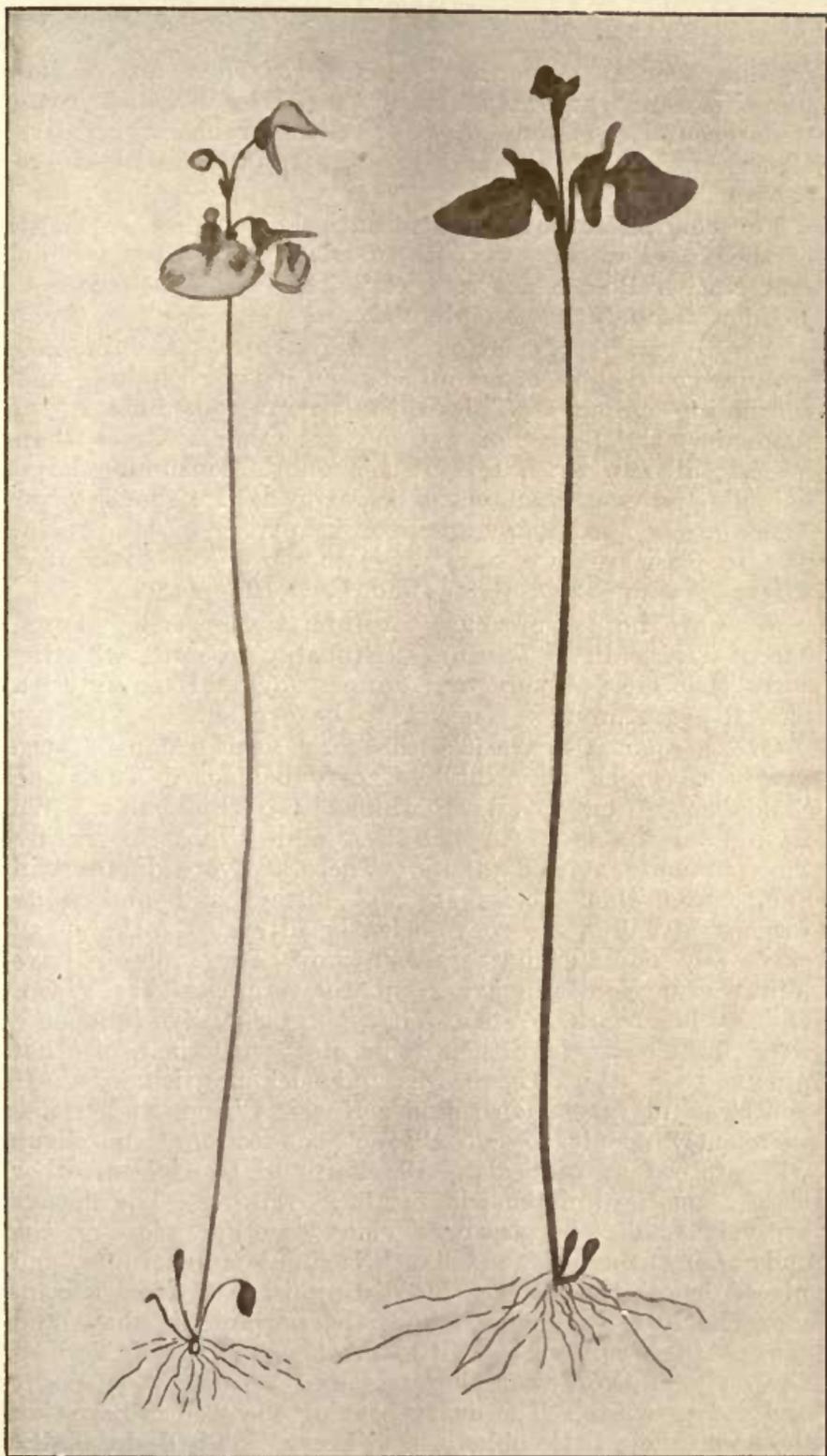
All plants have not this plant-green, and therefore do not perform these acts. The fungi, forty thousand strong in species, are without it; so are isolated cases, even amongst flowering plants. When this is so the habit of a plant is similar to that of an animal, in so far that it is dependent for its well-being on being able to absorb compounds already formed.

There is no rigid line between plants with plant-green and without. There are all grades of intermediate condition where it is present, but not in sufficient quantity to enable the plant to do all its work, where it is partly dependent on its chlorophyll and partly upon absorption.

It is probable that normally green plants cannot absorb high compounds through their roots. Though the mixing of such, as manures, are of great use, they are first reduced to a relatively simple condition before they can be taken up.

The first condition of departure from the normal is for a plant to gain the power of absorbing the material of dead animal and vegetable remains. As it gains this power it ceases to construct chlorophyll, and therefore ceases to be green. It may be white or any other colour but green. Some orchids and the greater number of fungi are in this condition. They thrive amongst rotting plant remains, and assist in the breaking up of such material and bringing it into use again. Plants that live in this manner are called saprophytes.

The next condition we notice is that plants may form an attachment to others, and suck some of their required nutriment from them while still retaining the power of



BUTTERFLY PLANT.
(*Utricularia dichotoma*, Lab.)

[See p. 130

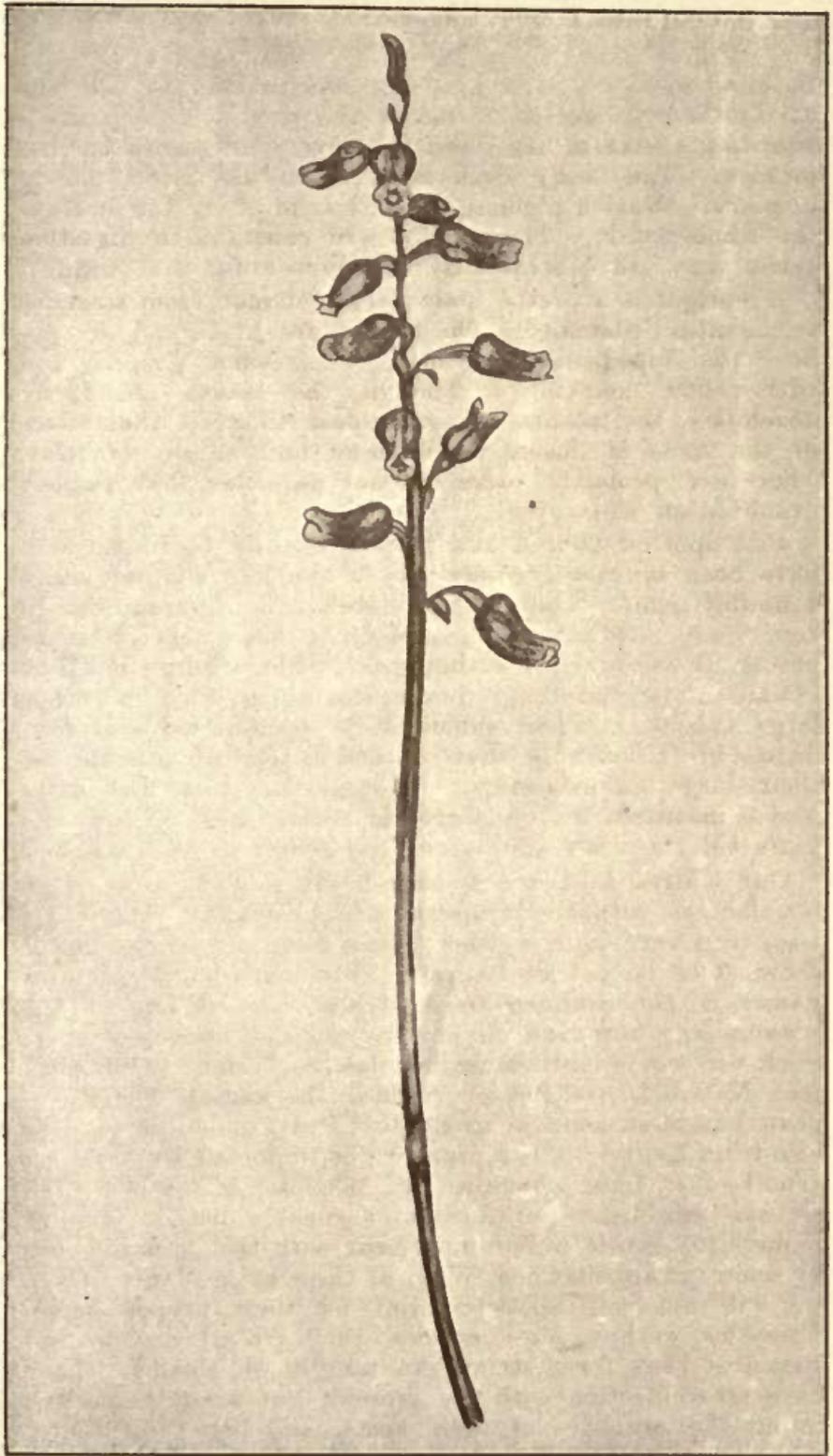
forming food in the ordinary manner. These are partial parasites, and they may attach themselves by their roots underground, or may grow on their branches. Native Cherry and Eyebright and the Australian Mistletoes are examples of this.

Further, plants may become entirely parasitic, as many of the fungi causing diseases of plants. Spotted Orchid and Native Potato are root parasites; our Mistletoe and Dodder are parasites on plant stems.

A very interesting means of adding to the stock of food without the trouble of manufacturing it is by catching and consuming animals. This is the carnivorous habit. No plant has the power of preying on animals larger than insects; all further statements, as plants consuming large animals and even man, must be taken as travellers' tales. There are a good many carnivorous plants in the world, and in Tasmania we have at least ten species belonging to two genera, the Sundew and Butterfly plants.

We have no conspicuously saprophytic flowering plants, except a rare little *Thismia*. Probably research will discover that more of our wild flowers have this power to a partial extent, but it has yet to be proved.

Of the partial parasites the most conspicuous is the family to which our Native Cherry belongs. It is the Sandalwood family, all of which have this habit. We have seven species, of which Red and White Cherry are the commonly noticed plants. These are very different in habit, and their fruits are not always red and white respectively, but are so sufficiently often to make it an easy way for immediate recognition. These plants have minute functionless leaves, but the branches are green, and do their work. When quite young they live independently, but soon, where their roots meet with those of other plants, they attach themselves and suck nourishment. If you clear all vegetation round a Native Cherry and trench sufficiently deeply to cut all root connections, the shrub will proceed to die; also, all efforts to transplant other than a small specimen will result in failure. The flowers are very small, and arranged many together, close on the ends of branches. The perianth is simple and minute, and placed below the ovary; this distinguishes it from a common closely allied genus, where the perianth is above and crowns the fruit with a little crest. As fruit is formed the stalk of the flower elongates and becomes very fleshy and red or white. The ovary bearing the seed is borne on the apex like a little oblong hard berry. This fleshy stalks



NATIVE POTATO.
(*Gastroides sesamoides*, R. Br.)

[See p 130

induced someone with a strong imagination to call the shrub Cherry, and gave rise to the painful exaggeration that in Australia the cherries bore their stones on the outside. The fleshy stalk is of much use as an aid to dispersal. Native pigeons are very fond of it, and swallow the whole fruit. The ovaries are resistant to digestive juices, and are subsequently distributed far and wide.

Eyebright is a pretty little herb, common from seashore to mountain plateaux. The flowers are numerous, irregularly two-lipped, white or mauve, sometimes striped, and with yellow markings. Though the leaves are fairly developed, the plants always appear to avail themselves of the roots of others to increase their supply of food. There are probably other partial parasites that patient examination will reveal.

Pink-spotted Orchid and Native Potato, both of which have been sufficiently described in the last chapter, have a similar habit. They do not develop plant-green, but in very early life attach themselves to the roots of other plants, at whose expense they grow. For a long time they remain underground, gradually storing up food in rather large tubers. When sufficient is accumulated and conditions are favourable, they proceed to send up into the air their large inflorescences. Though the stem dies after seed is matured, the underground portion lives on for some years till the roots supplying food ceases to be available.

Our Native Mistletoe is very badly named, as it is no relation to either European or Australian Mistletoe; also, it is very unlike either. The structure of the flower shows it to be a true Laurel. This confusion of popular names is not confined to Australia, and is one of the reasons why botanists do not use popular names oftener. Such use would only cause hopeless confusion. Our common Native Laurel has no right to the name. The European Laurel so common in English and Tasmanian gardens also is no Laurel; it is a plum. The imported Baytree is a true Laurel, *Laurus nobilis*; our Mistletoe is another. Till we can establish a uniform and sensible list of popular names, the gentle public must bear with the pain inflicted by scientific appellations. Well, of these little plants, which we will not call Mistletoe, but by their proper name, *Cassytha*, we have three species; they are all wiry leafless parasites that form string-like tangles on shrubs. They have no connection with the ground, but wind themselves round the branches of their hosts, and here and there, where they touch, they form little cushions of tissue, in

the centre of which a process burrows its way in, and not only forms a means of attachment, but a permanent means of sucking nutritious juices. The largest species is Black *Cassytha*, which is rather coarse and bears a black berry. It does not occur in the south. Velvety *Cassytha* is the commonest. Very often found in Buloke; sometimes on other shrubs it forms a dense mass and has a round green berry covered with delicate microscopic hairs. Smooth *Cassytha* is more slender and spreading. It grows on small shrubs in heathy places, and bears a small oblong reddish berry.

The flowers are minute and few, close together. Each has six small perianth segments in two series of three each; twelve little stamens also in two series. Some of them are not perfect, but where they are the anthers are interesting objects. Instead of opening in the ways of anthers we have already described, they do so by a little valve which opens below and curves upwards. This is a condition found in all Laurels. Dodder, which is such a pest in fields of Lucerne, has a similar habit to *Cassytha*, but it belongs to quite a different group. The structure of its flower indicates it to be a degenerate member of the *Convolvulus* family.

The carnivorous habit of some plants is always a marvel to the observer; it seems such a great departure from what we figure to ourselves as proper behaviour. Yet they are much more common than is generally supposed. As they can only capture small beings, they are generally called insectivorous plants, which is not strictly correct, for other animals besides insects often fall a prey to them.

We have about six species of Sundew or *Drosera*, which are all noticeable for having leaves adorned with many hair-like structures, at the tip of each of which is a dew-like drop of sticky fluid. This contains a ferment very like that contained in the gastric juice of animals, and has the power of dissolving flesh. If a small fly or an ant finds its way on to a Sundew leaf in good health, the hair-like structures bend towards it till their fluids cover its body. This, from its viscosity, impairs movement, and prevents escape. The muscles are now slowly dissolved and absorbed into the tissue of the leaf, the hard skeleton remaining behind. The same act is induced by placing a minute piece of white of egg or meat upon the leaf. It is further singular that these tenacles have the power of discriminating between flesh-containing and other substances. If a useless bit of material is placed upon the leaf they

do not respond. Droseras can do without animal food, but thrive better when it is added to their diet. If it is given in excess the health of the plant is injuriously affected.

Droseras have flowers of the Saxifrage type, and are only separated from that family on account of their peculiar habit. There are four or five sepals, the same number of white or pink petals, and generally the same number of stamens; all are inserted into the thalamus close below the pistil.

We have seven species, four of which have small shield-like or kidney-shaped leaves. One of these, *Drosera pygmaea*, is very small, bright red, and close to the ground; it could be completely covered by a sixpence. *Drosera binata* is often a foot high, with leaves shaped like a tuning-fork. *Drosera arcturi* grows on the top of mountains, and bears long flat leaves and single white flowers.

The other genus of our carnivorous plants is more scarce, and though there are four species, only Butterfly Plant is likely to be gathered. The flowers are generally borne in a single pair at the apex of a slender stalk a few inches high. Purple or white, with a small upper lip and a large spreading lower one; they are very conspicuous in some wet places. Where they grow on the ground the leaves are few, small, narrow, and green, close at the base of the stalk; but when the leaves find themselves in water, they grow into long branched strings that bear numerous little colourless sacks. Each sack has a peculiar mouth that permits the entrance of a small animal, but prevents its escape. Little glands on the inner surface secrete a fluid similar to gastric juice, which proceeds without apology to digest the unfortunate victim.

Chapter XIX.

THE NON-FLORALS.

There are a great many plants which have no flowers or only very primitive ones, and therefore do not exactly come within the scope of this work, still they deserve some slight record. (The Pine family, unfortunately for us, does not form forests of timber trees, as it does in many parts of the globe, but we possess some most interesting species from a scientific point of view.) Most of our Pines are vestiges of a bye-gone age. (Huon Pine, which lives only in wet parts of our ever moist west, produces wood of a superlative character.) King William, which yields one of the lightest woods in the world, belongs to a passing away genus. Its only relatives to be found to-day are one in the dismal swamp of America, one in Japan, and two, Mammoth Tree and Redwood, north of California.

The Club Mosses are unfortunately named, as they are not at all related to mosses. It is better to call them (Lycopods, and recognise that they are more related to the Pines. They appear to be dwarfed descendants of the vegetation of the coal measures.)

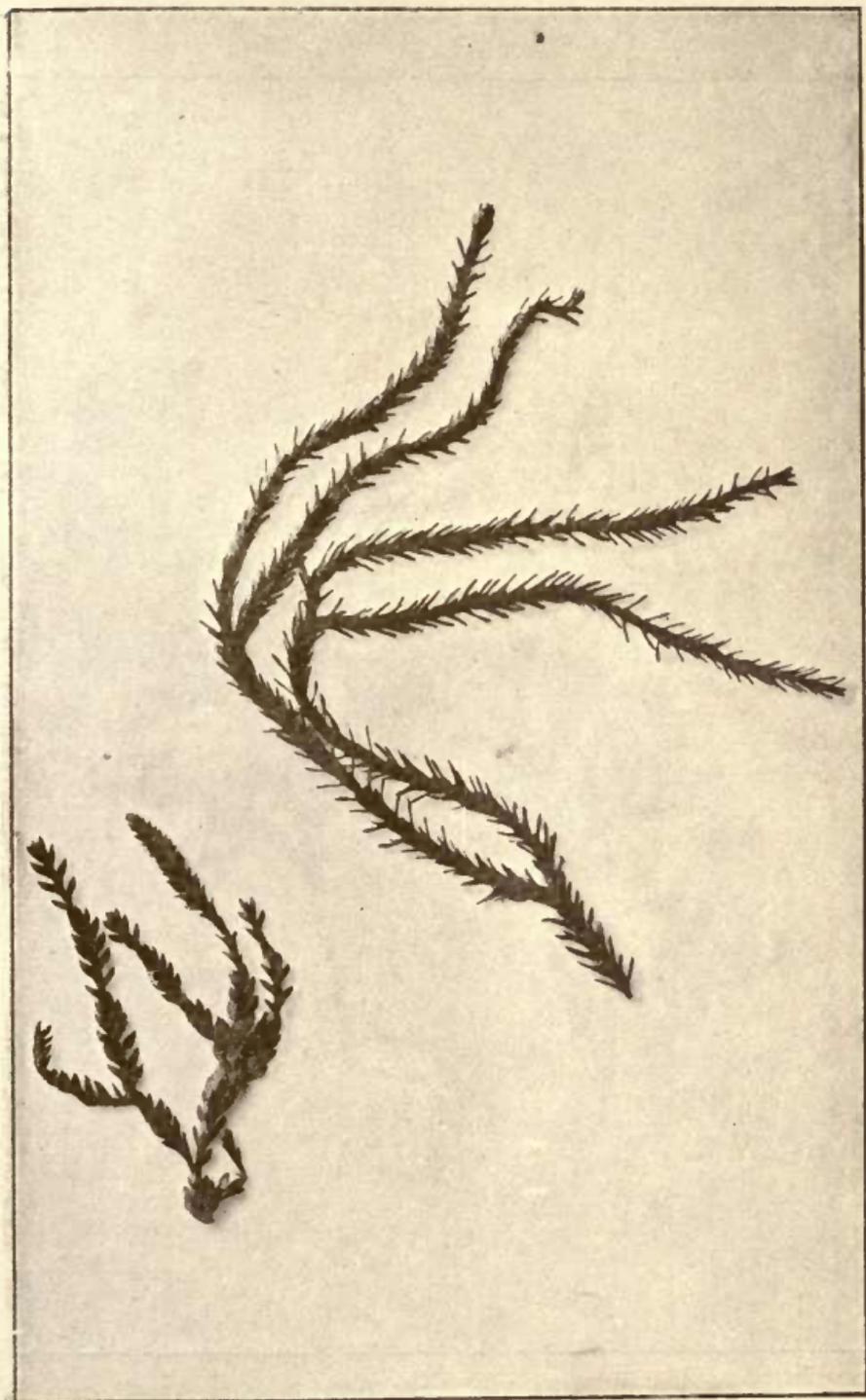
Two plants placed in this group chiefly because they will not fit in anywhere else are of exceptional interest. They are Quillwort and Tmesipteris. (Quillwort is common in our lakes, and has leaves like a porcupine's quills.) It is widely distributed throughout the world. Being a water-plant it is carried about by migratory birds. It is apparently a direct descendant of the Lepidodendrons of the very ancient earth. (Tmesipteris, which has no common name, is found occasionally on the trunks of tree-ferns.) It is confined to Australia and Southern Pacific, and probably is one of the only remaining relatives of the equally ancient Sphenophylls.

(Tasmania is well off for ferns, possessing nearly eighty species.) Good as this is, New Zealand has about twice as many. The typical fern is probably not a very old type; there are perhaps more species existing in the present day than at any other period. The fern-like leaves of the coal measures appear to have belonged to a group of plants, the precursors of the seed-bearing plants. (Of the moss group there are in Tasmania about three hundred and fifty true mosses, and about three hundred Liver-



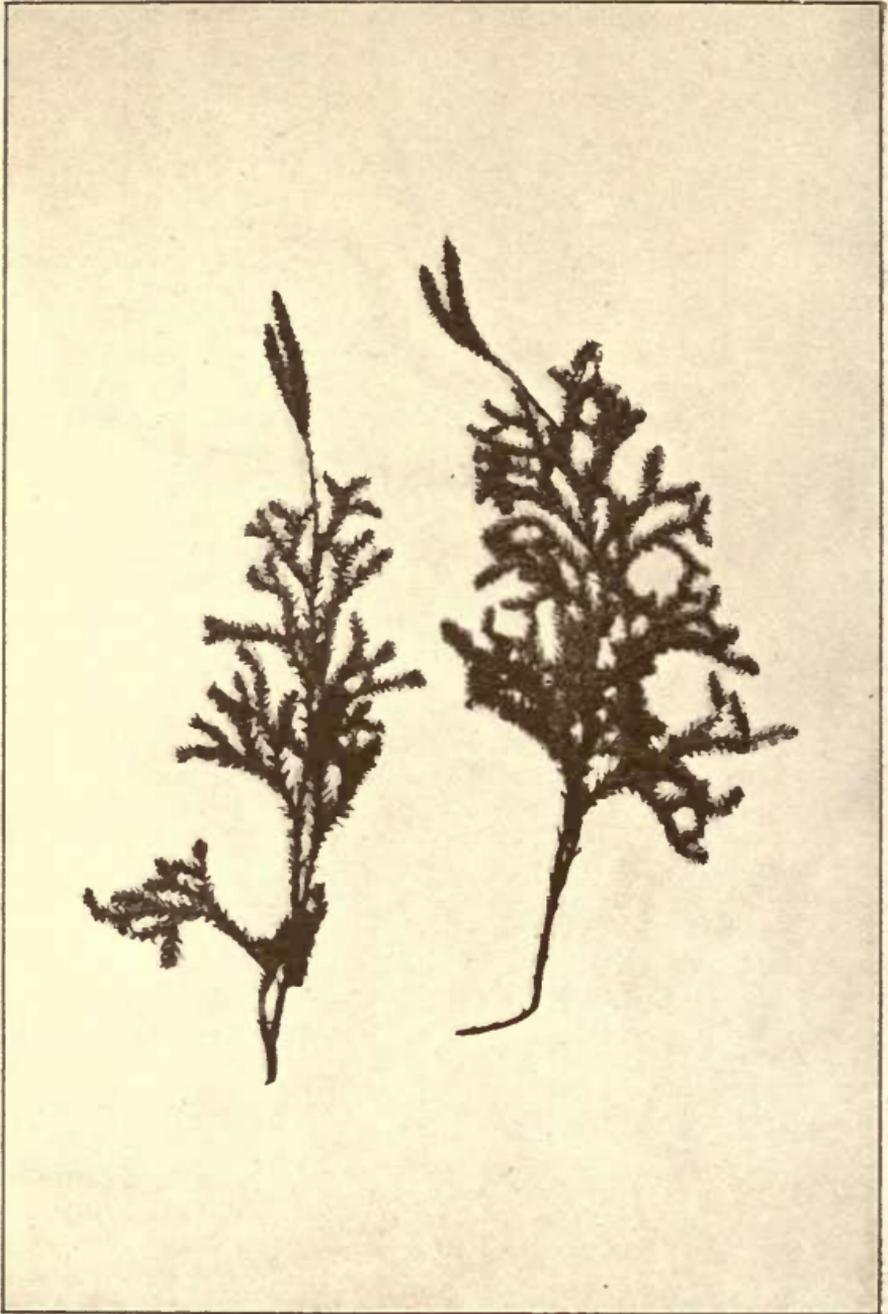
KING WILLIAM PINE.
(*Arthrotaxis selaginoides*, Don.)

[See p. 135



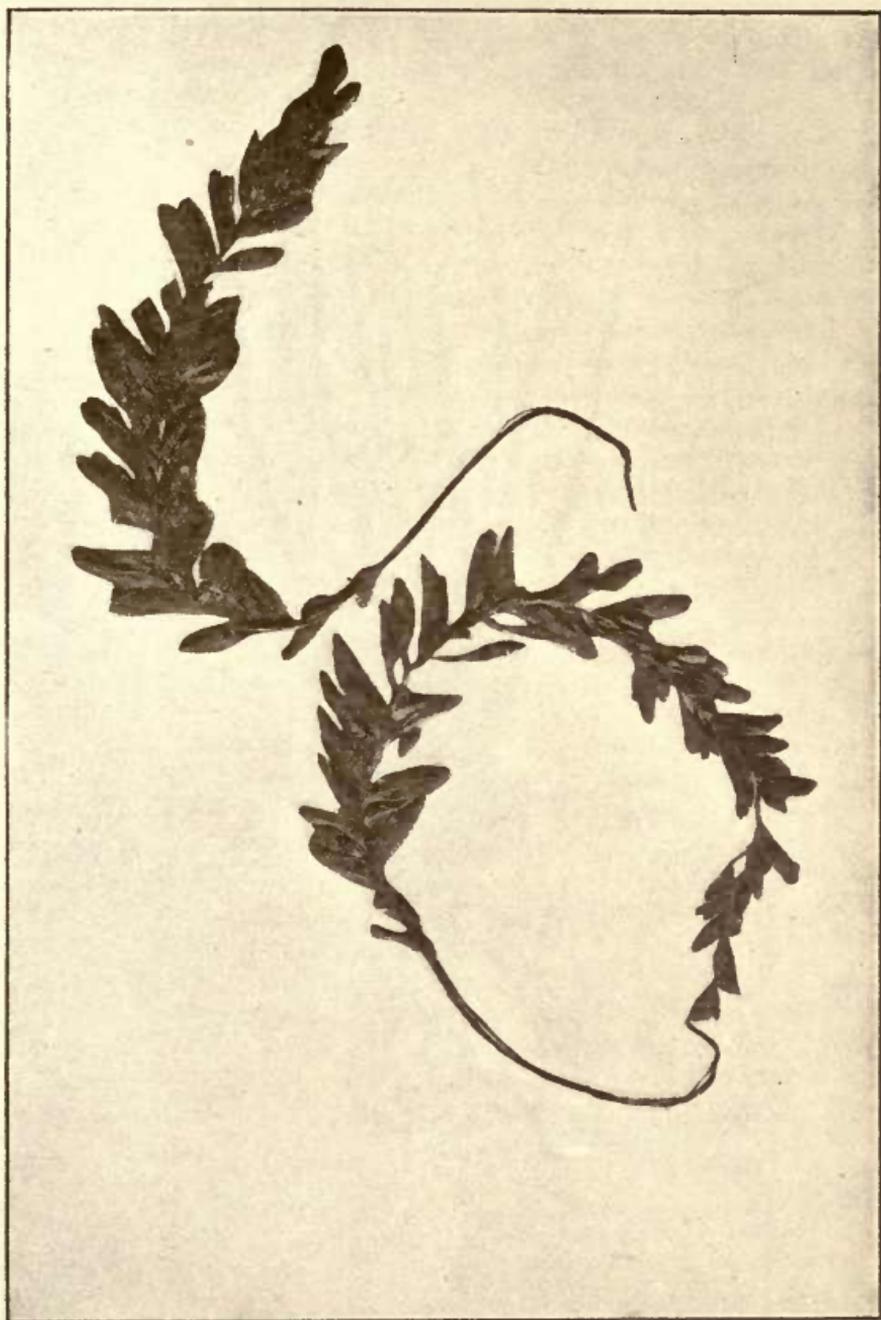
CLUB MOSSES.

(*Lycopodium scariosum*, Forst. *Lycopodium selago*, L.) [See p. 135]



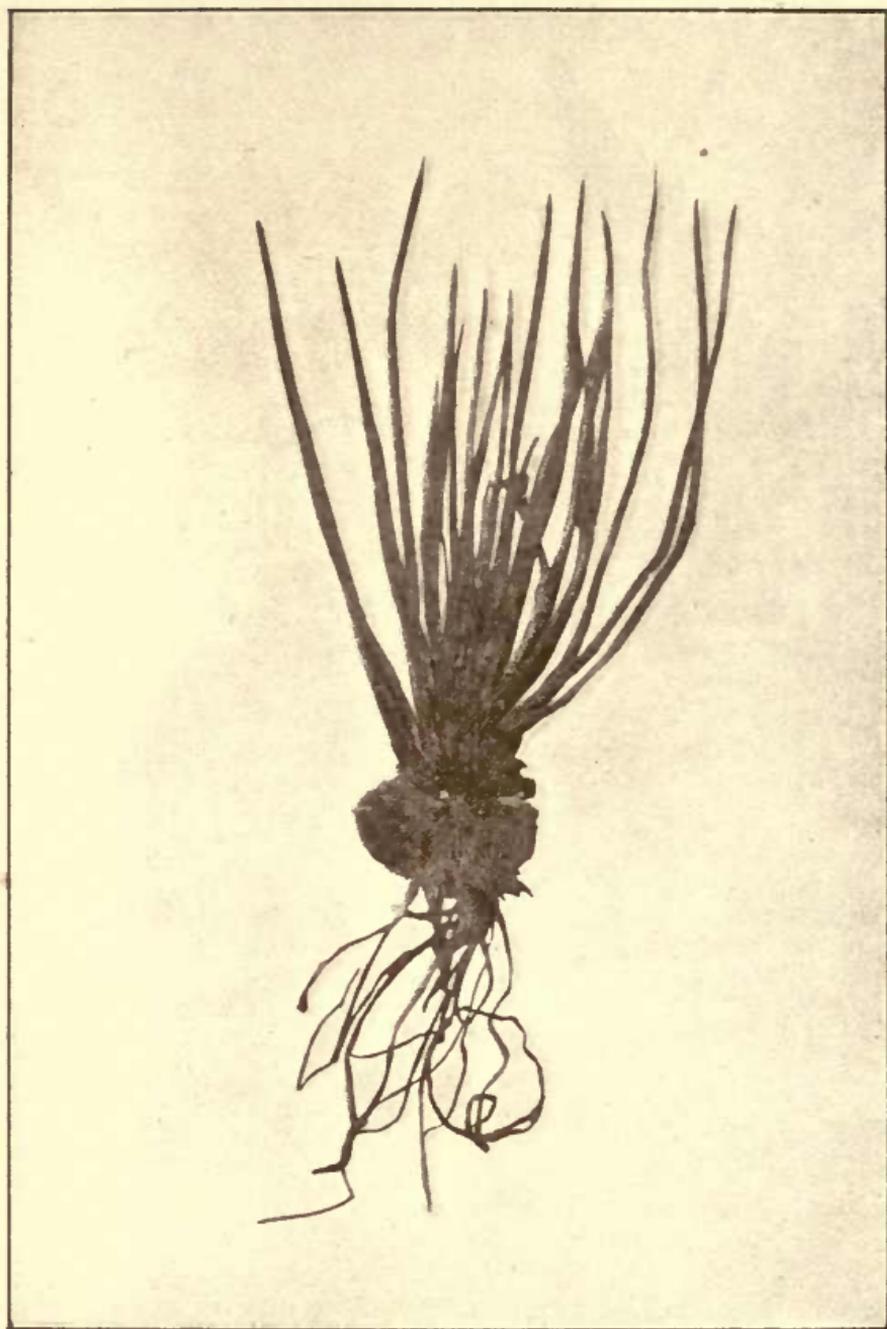
LYCOPODIUM FASTIGIATUM, R. Br.

[See p. 135.]



TMESIPTERIS TANNENSIS. Bern.

[See p. 135



QUILLWORT.

(*Isoetes elatior*, F. v. M.)

[See p. 135

worts. Probably no part of the world of a like size is so rich in species of this latter section of the family.)

There is one class of plant which deserves far more attention than it gets, and that is the Fungi. The weird forms and often minute size render it unattractive to the young student, but its importance in the scheme of nature, and its clashing with man's interest makes it a difficult, but most important line of research. The objects we call fungi are only the fruits of the plants. The real body consists of threads which permeate the wood, or soil, or living plant, and when it proceeds to propagate it produces on the surface one of the peculiar growths according to its kind. Unlike green plants, fungi do not form food for themselves, but procure what they require from plants, living or dead, even in some instances from man.

Fungi are often parasitic, such as rust in Wheat, Black Spot on Apples, Thrush, Ringworm, or Diphtheria in man.

Most Fungi live on dead plant remains, and as such does some harm, but an immense amount of good. Were it not for these plants, plant remains would not rot, but would lie an encumbrance upon the earth.

People as a rule call all umbrella-shaped Fungi which are not Mushrooms by the one name of Toadstools, and think they are poisonous. It is better to call them by their scientific name of Agaric. Very few of the thousands of Agarics which exist are poisonous. Many of them are used for food on the continent of Europe.

Chapter XX.

THE SPORE AND THE CELL.

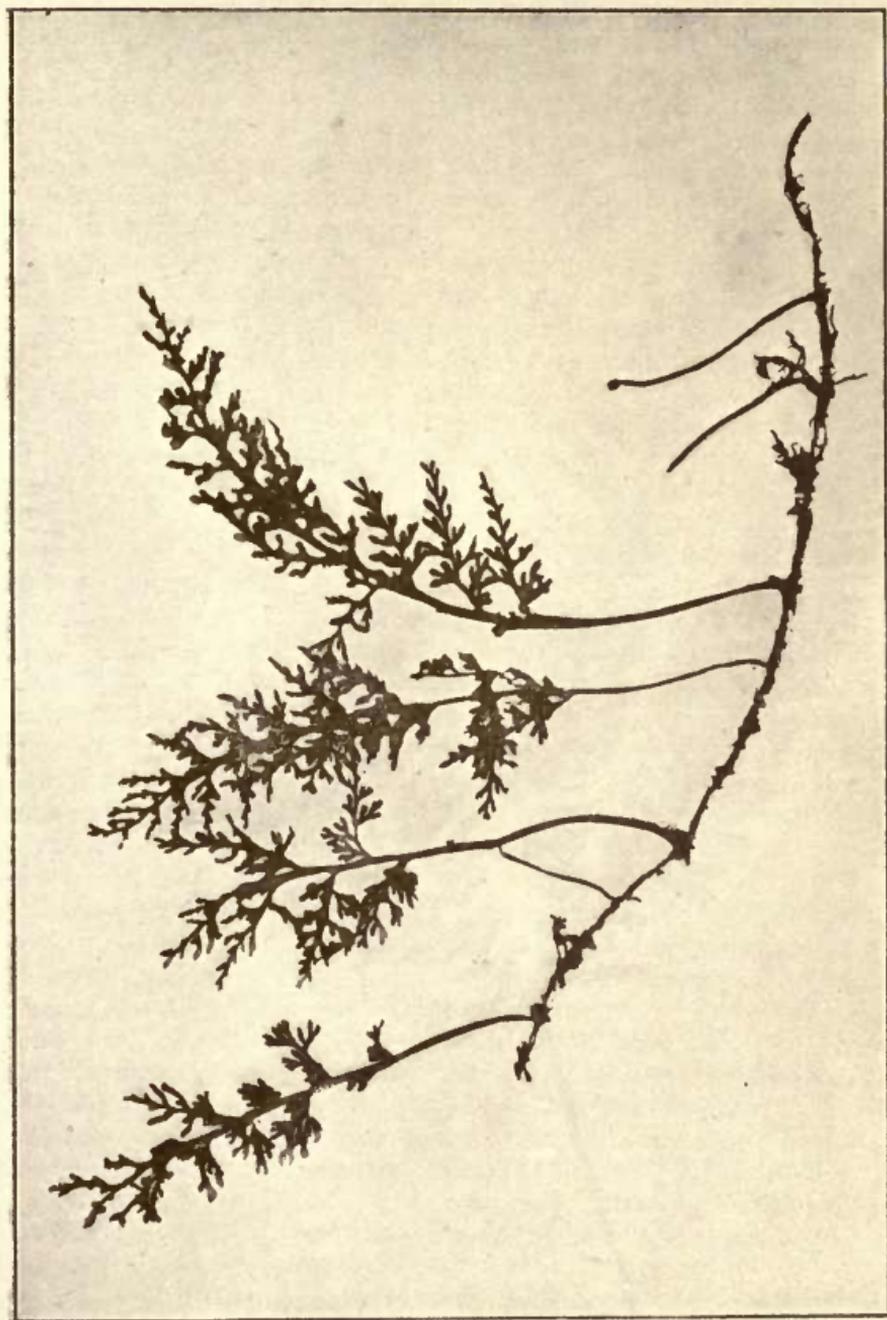
There is one peculiarity appertaining to matters referring to living things, namely an impossibility to construct a perfect definition. For instance, taking the word spore, we use it freely, and understand fairly well what we mean when we use it, but although in most instances we may accurately define any particular spore, we cannot construct a definition to include all spores.

A spore is a free protoplast enclosed in a cellulose case. Then there are spores which have no case, for instance, the megaspore of a flower. A spore may not be free as in the compound spores of many Fungi. Again, there are many single free protoplasts which are not spores. A spore is a single protoplast which is employed in the function of propagation or reproduction, yet there are other things, such as gemmæ, with a similar function, which we do not call spores. Spore production we may trace in the highest to almost the lowest of plant forms.

A simple form of spore production is that with which we are familiar in the case of ferns and mosses. Sacks are formed full of little spores. When ripe the sack bursts, and the spores are blown about by the wind. In ferns, the spore sacks may be seen like fine brown dust in clusters on the back or margin of the leaf. In mosses the spores are contained in single large cases, commonly referred to as the moss-fruit. In both these instances the spores are all of one size.

In several distinct instances dame Nature has bethought herself that economy may be effected by producing spores of two sizes; large or megaspores of a passive nature, and small or microspores whose duty it is to fertilise the others. This is the condition we find in many lowly plants, and likewise in Fir-trees and Flowering plants. In the latter the microspores are formed in the anthers, and the megaspores in the pistil.

In the case of an ordinary fern the spores do not grow into young fern plants, but into quite a different form. The spore on germination grows into a small, flat, green, heart-shaped plant, called a prothallium. On the under-surface of this the essential organs of reproduction develop; fertilisation takes place, and a young fern plant is the



HYMENOPHYLLUM JAVANICUM, Spreng.

[See p. 141



UMBRELLA FERN.
(*Gleichenia flabellata*, R. Br.)

[See p. 135

result. Thus a fern has a dual existence, one generation only developing spores, and the other the organs of reproduction. This is called the Alternation of Generations. In the Fir tribe there are both micro and megaspores; the former dusty, and very like the spores of ferns, the latter are larger, and formed on the bracts of the cones. The megaspores are not shed, but each develops a minute prothallium within the spore; on this is developed the germ which will be fertilised by a microspore, and will then grow into an embryo or seed of the Fir. In flowering plants the same takes place, only the prothallium is reduced to a few obscure cells. So in these instances the spore-producing generation is the important one, and the reproducing generation is insignificant.

In mosses the reverse is the case. The Moss-plant develops the organs of reproduction, fertilisation takes place, and the embryo develops into a single spore-producing case, which is generally on a tall stalk, and lives permanently attached to, and deriving its nourishment from, the mother plant, and is called its fruit.

In the days of old but little interest was taken in the study of plants, though a greatly exaggerated idea of medicinal properties gave work to primitive physicians known as herbalists. Those who pursued them had to confine their studies to external characters because they had little means of seeing further. With the advent of the microscope this was changed, and earnest students soon took advantage of this instrument to unravel the mysteries that existed beneath the surface.

One of the first things noted was that when a transverse section of a plant-stem was made, the appearance it assumed had somewhat that of a minute honeycomb. It seemed to be made up of small chambers. These were filled with fluid, but that received no attention, and the plant was considered to be made up of these chambers which had the ability of growing and multiplying. As the spaces in a honeycomb were called cells so these spaces in the plant tissue received the same name. Even to the present day the name has survived for the ultimate structure of plants and animals, though its meaning has long since passed away.

In the fullness of time it was discovered that the cell-walls were simply non-living cases, and the viscid fluid contained was the true living substance. We know now that this viscid fluid is a highly complex material compounded of hundreds of atoms of some ten different ele-

ments, whose constant change is the physical basis of what we understand as life. It has received the name of Protoplasm. We know that Protoplasm in the mass does not act as the living material, but that it consists of minute bodies each of which acts as an independent living being. Unfortunately the name cell got to be extended to these bodies, which are not like cells at all. It is better to call them Protoplasts. All plants and animals are built up by these protoplasts. These little beings are like workmen who build a house, the cell-wall is the structure built mainly of a substance called cellulose, the contained living being is the builder, and he builds to an inherited plan.

A protoplast is not a simple mass of protoplasm, but consists of definite parts. There is a nucleus which appears to exercise control, also many more or less specially shaped bodies which do work in constructing material, some are green, others coloured or colourless. They all have their duties, and they, together with the nucleus, are embedded in a portion of protoplasm which is given the special name of Cytoplasm.

Chapter XXI.

THE HERBARIUM.

A student who takes any interest in the study of plants is certain to make some sort of a collection of dried specimens. He may just as well make a creditable collection while he is about it, and save himself a lot of future trouble when he comes to value his work. At the very outset a student may collect small pieces of flowering shrubs or ferns, and, after pressing till dry, mount them in a drawing book or album, attaching to each specimen the name, date, and place where found. This is a satisfactory procedure for a time, and useful to familiarise one with the scientific names of plants, but as soon as the very juvenile period is passed, a serious collection, now called a herbarium, should be made.

Never gather rubbish. The collection will rapidly grow, and soon all the poor specimens will have to be thrown out to make room for better ones, and so much labour and material will have been lost. Gather specimens with good flowers or fruit, and these when properly dried and mounted will last for all time.

Let your specimen be a liberal size, say twelve inches long. Where the whole plant is smaller than this, mount stem, roots, and all. Where very small, fix many plants on the mount, and if advisable put them in envelopes, and stick the envelopes on the mount. Where the specimen is clumsy trim off leaves and side-shoots till the specimen will lie flat on the paper. Never gather in damp weather or mildew will ruin the flowers. Before your specimens shall have time to wilt proceed to press them: This is done by placing each specimen between folds of absorbent paper or many layers of old newspaper, and keeping them under pressure till quite dry. Unless the plants are of a very dry nature the paper must be frequently changed, and the frequency will depend on the nature of the plant. Any neglect means mildew, and rotting of delicate parts. A very effective press may be made by putting the bundles of paper and specimens on the floor, a flat and broad piece of wood on the top, and on this heavy weights, such as iron, stones, or bricks.

Some succulent plants, as for instance our Rock Lily, will continue to flower and go to seed while in the press. To prevent this, the plant, all but the flowers, may be plunged into boiling water for a second or two. Some heaths will too readily shed their leaves when dry; the same treatment if applied will have a beneficial result.

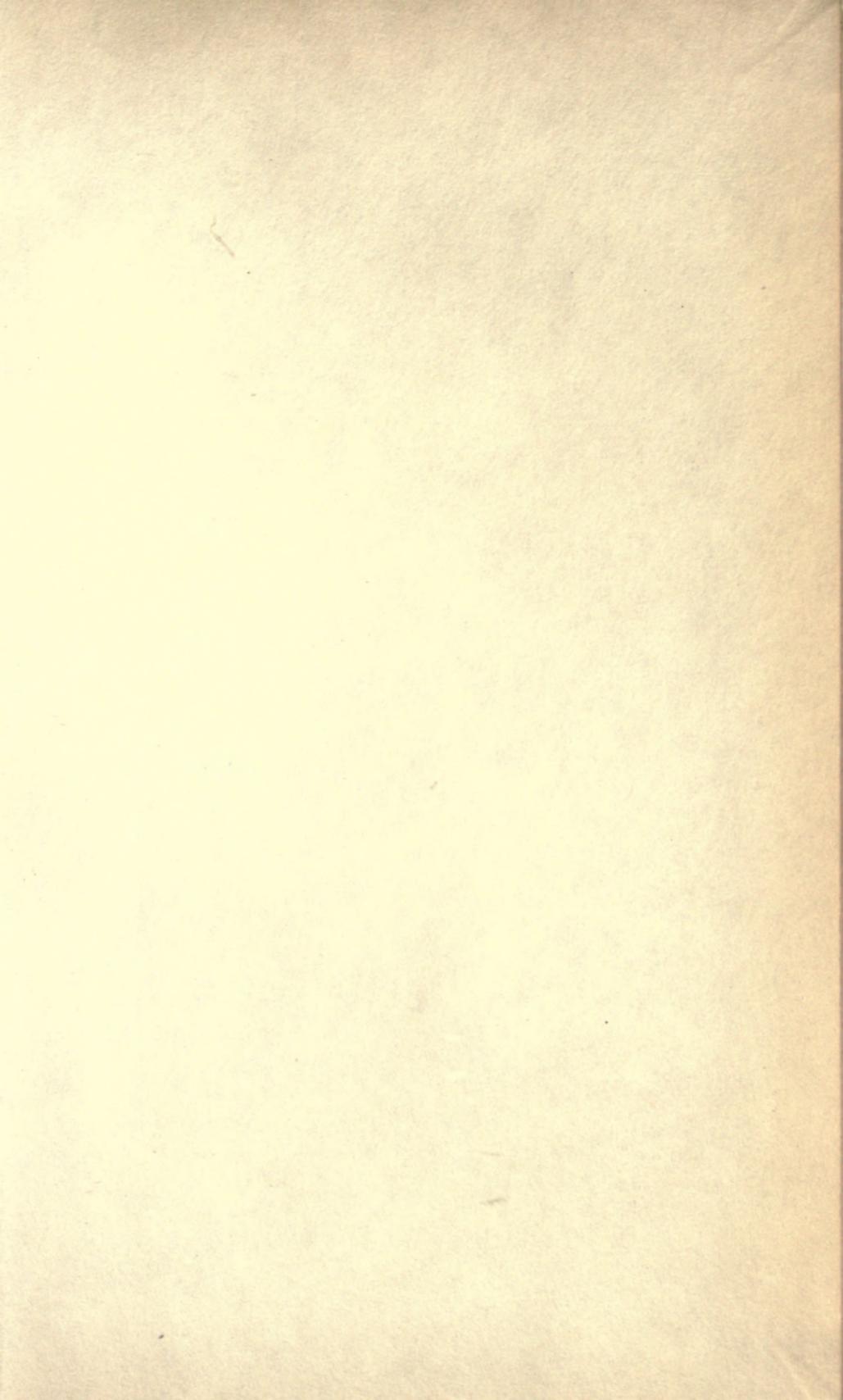
Succulent plants, such as Orchids, may be satisfactorily dried by placing between absorbent paper, and ironing with a hot iron.

When the specimen is properly dry it may be preserved in folds of paper or in boxes, but the more convenient method is to mount it. This is done by attaching it to a sheet of paper by the use of gum, or by sewing or by strips of lead. The mount may be of any quality from cartridge paper to old newspaper, according to one's disposition to economise. The size should be uniform, say 15 inches long by 9 broad, certainly the sheets should not be much smaller or there will be trouble when large specimens have to be dealt with.

On the mount a label should be attached, giving the name of the plant, where gathered, by whom, and date. Details of structure may be drawn on the paper.

Small insects are rather fond of herbarium specimens, and will destroy our precious objects if not prevented. Specimens may be rendered poisonous by being dipped in a solution of corrosive sublimate or, better, by sprinkling a little naphthaline between the sheets. Ferns require the same treatment as flowering plants, only never keep specimens unless they have the masses of spore sacks on them. Sterile leaves are worthless. Mosses are very convenient plants to collect, for they may be stuffed in a seed envelope, and when wanted readily soak out to their original form. Sterile specimens of mosses are of value, but fruiting ones are better.

Fungi afford a fascinating pursuit, but one cannot go far in it without the use of microscope. Many of them do not change when dry, others will restore fairly well when soaked, others again, such as the Agarics or Toadstools hopelessly degenerate. Such plants can only be recorded by making a correct drawing in proper colours, for colour is of great importance in these Fungi, noting also size, colour and shape of the spores. The specimens when mounted and labelled will be kept in portfolios or cabinets according to the convenience of the collector.



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