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HANDBOOKS OF PRACTICAL GARDENING
EDITED BY HARRY ROBERTS

THE BOOK OF FERN CULTURE



POLYPODIUM KNIGHTIE
A handsome Fern for baskets

THE BOOK OF FERN CULTURE

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LONDON: JOHN LANE, THE BODLEY HEAD
NEW YORK: JOHN LANE COMPANY. MCMVIII

1908

THE BOOK OF FERN CULTURE

INTRODUCTION

IN the following pages on "Practical Fern Culture" the writer has endeavoured to give brief instructions regarding the requirements of the most popular Ferns, with the aim of assisting those who have had little or no previous experience. It is also hoped that older growers will also find some notes of interest. The writer's experience extends over nearly forty years, during which time he has been more or less associated with Ferns and their culture, and has seen great changes. In addition to having been associated with one of the largest Fern growers for about sixteen years, the writer has gained much experience from visiting other nurseries where Ferns are extensively grown. Ferns, or rather most of them, are no longer regarded as semi-aquatics, to be kept continually moist and under heavy shading and green glass. It has been fully proved in practice that those things are a great abomination. It was before the Kew authorities abolished green glass for the Fern houses that the writer of these pages commenced to condemn its uses, and in the Horticultural press no opportunity has been lost of further depreciating its value. While not wishing to underrate what many excellent authorities have written, it may be found that the instructions given in the following pages appear contradictory to much that has been previously published. The excuse is that in following practical results,

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it has been found that Ferns may be grown well and much more economically than they were under the older methods of treatment. And it is hoped that the result of this experience may prove of use to others.

No attempt has been made to deal with scientific principles or botanical accuracies. The author believes that the names which have been so long in use, and which still appear in catalogues, will be of more assistance in practice than the strictly botanical nomenclature. Taking as an instance the British Lady Fern, it may be quite correct to put it with the *Aspleniums*, yet it will long be known as *Athyrium*. *Davallia Mooreana* has been known for many years, and now there are few outside those who study botany who would know that it should be named *D. pallida*. *Stenochlæna scandens* became popular under this name some years ago; now it is named *Acrostichum scandens*. Other examples might be given, but the above will be sufficient to show the difficulty of combining the scientific with the practical. In dealing with Ferns, as with other plants which come under cultivation, it is not always advisable to try to follow natural conditions too closely. Yet there are some points which are essential. Take, for instance, the native and other hardy Ferns. They mostly grow in the shade of deciduous trees which come into leaf late in the Spring, after the Ferns have made a good start. When the leaves fall in the Autumn, day-light is again let in, while the leaves, grasses, etc., that have grown up around the Ferns all give some protection during the Winter, and when further decayed these accumulations afford new surface matter for the roots. Now, in what may be termed a neat garden, all these accessories are removed, and the Ferns suffer in consequence. This is one great reason why the hardy Ferns are not more popular. Many Ferns which are found growing in leafy or peat soil are equally at home and do

better with loam, the natural conditions being simply a matter of accident rather than necessity. It is often suggested that Ferns do not require manure, yet under natural conditions birds and various small animals manure the ground, and the decayed leaves, etc., give further assistance.

It has been proved that Ferns may be grown larger under cultivation than they are ever seen growing naturally.

In giving a brief summary of the various classes of Ferns and their culture, many omissions may have been made. And perhaps some of the instructions may appear rather tedious, yet it is due attention to small details on which success depends. Careful and regular attention will lead to success, where all the most expensive appliances, and best materials will be of little use if not properly applied.

In conclusion, it may be remarked that no writer can give such instructions as will lead to absolute success; but it is hoped that the following pages may materially assist those who carry them out in a practical manner.

CHAPTER I

PROPAGATION

FERN propagation is one of the most interesting branches of Horticulture. There are so many methods by which stock may be renewed, or increased. And it is interesting to note that it is those species which fail to reproduce from spores, which are most readily propagated by some other means. Take *Adiantum capillus-veneris* var. *imbricatum*: this produces tiny little bulbils round the margins of the fronds; and these, when laid on suitable soil, will soon form young plants. It may be added here that in some instances it has reverted to the normal form, or more like *A. c. p. magnificum*, and spores have been found, but the best type is barren of spores. The dense growing *Scolopendrium vulgare*, var. *Kelwayi*, on well matured fronds, develops tiny bulbils which may be taken off and treated as small seedlings. Another variety of *Scolopendrium* produces bulbils on the surface of its fronds. Many of the *Aspleniums* are very prolific in surface bulbils. Other Ferns produce root bulbils, others have spreading rhizomes. These are all dealt with in their proper order. In almost all instances where spores can be obtained, it will be found to be the best method of propagation. The collecting of the spores is of great importance. All choice sorts should be taken from plants isolated as far as possible from the free growing species, or what may be termed Fern weeds. The worst weeds are *Nepbrodium molle* *Gymnogramma Martensi* and the free growing *Pterises*.

The spore fronds should be collected as soon as they show the first signs of maturity, for in many Ferns all the best spores fall away as soon as the spore cases open. Take *Osmunda palustris*: the proper spores are of a green colour when ripe, and they fall very quickly. In *Pteris argyrea* they are quite black, but in a day or two after the cases open there will be nothing left except the brown receptacles. In most of the *Davallias* the spores are yellow. In the *Gymnogrammas* the true spores are nearly black, but some take the white farina, or powder, to be spores. The *Adiantums* vary; in *cuneatum* they are dark, while those of *scutum* are pale yellow. If the fronds are collected at the right time, put into paper, and placed in a dry place, the spores will, in most instances, fall out naturally, and rubbing of the fronds will only secure the woolly part of the receptacles. There are some exceptions. Take *Onychium Japonicum*: the spore cases may appear abundant, but spores will be scarce, and will have to be extracted by rubbing, while in *Onychium auratum* they fall out and are very abundant. Yet it is curious to note that while it is rarely that the former fail to germinate, it is difficult to raise the latter. It may here be added that, although it is supposed that spores will keep for an indefinite period, it is safer to rely on those freshly collected. This is especially the case with the *Davallias* and some of the *Adiantums*. Yet some instances have occurred where spores have germinated after being kept for a long time. We owe the reintroduction of *Asplenium marginatum* to *Herbarium* specimens, which were collected some years before the spores were sown. And other instances might be given where seedlings have been raised from very old spores, but they have generally been kept under exceptional conditions. And where possible to get those that have only been newly collected, it is much safer to use them than to rely on old ones. It may be added that Fern

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spores keep best in a dry warm position; after they are properly dried they may be shut up in a close tin box.

SOWING SPORES

The first thing is the preparation of the pots. The old method of filling them half full of drainage is a wrong one! A larger surface of soil will retain the moisture better. In the market-nurseries no drainage is used, the pots being filled with good loam, to within about an inch of the top. A thorough soaking with water is then given. After this a slight surfacing of powdered charcoal and crock dust, which should be shaken through a fine sieve, is given. Another watering may then be given. The pots will then be ready for sowing the spores. The most important matter regarding the sowing is to avoid being too liberal with the spores. I have found many failures occur through sowing too thickly. Another point is that where several sorts are to be sown at the same time, care should be taken that the spores which are being sown cannot float on to the pots that are to be used for other sorts. And after sowing one variety, a duster should be used to cleanse the hands and any part where the spores may have settled. When sown, the pots may be placed in a close warm frame, each being put in a saucer of water; or they may be placed in any convenient position where they get light without the direct rays of the sun coming on them, and each pot covered with a piece of glass. When this is done the glass should be reversed every morning to avoid the condensed moisture dripping on to the surface. No surface watering should be given after the spores are sown. Light is an essential, and I have found that those in the open germinate better than others which have been in a close frame where it has been necessary to cover to keep the sun off.

There is a considerable difference in the time it takes for the various species to germinate. Some begin to show the green prothallia in less than a week, while others may remain dormant for months. And it sometimes occurs that some other sorts may spring up while those desired remain dormant, and any stray seedlings should be removed as they appear. I have had two or three crops from the pots in some instances, before the variety actually sown has appeared. And I have also found that unless those which germinate early are removed as they appear, they will effectually choke the slower growing variety which it is desired to establish. There is some difference of opinion in regard to the time of sowing spores. Ordinary sorts may be sown at any time, but with the choicer varieties the best time to sow is early in the year. And in most instances this will give time to establish plants the same season, while if sown later they will not have sufficient strength to live through the following Winter. Most species require handling three times before they are ready for small pots. First, as soon as the seed-pots are covered with the green prothallia they must be transferred to others prepared with some light sandy compost on the surface. The sporling (or seedlings) are taken out in little patches with the point of a stick and lightly pressed on the surface of the newly prepared pots, giving from half to three quarters of an inch between each patch. After this is done they should be kept in a close warm frame for a time. A little later on they will require dividing again. And some may require dividing a third time. All seedlings raised early in the year may be started in warmth, but the hardy sorts should be removed to cooler quarters as soon as they are well established. All the young plants should be exposed for a time before potting off singly. A good position is on a shelf close to the glass, the tender sorts in the warmest part of the house, and the hardier sorts

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may be transferred to a cooler house. After potting off singly they require some care ; very little water should be given until they make a fresh start. Many young seedlings are lost through over-watering, and being kept too close. Those propagated from the small bulbils require similar treatment to that given to those raised from spores, but there are some which may be rooted either on a bed of suitable soil or in pots before detaching them from the parent fronds ; with some, such as *Woodwardia orientalis*, and some of the viviparous *Aspleniums*, the bulbils fall off when they have made the first tiny frondlet. While with *Woodwardia radicans* a larger bulbil is formed towards the extremity of each frond, and occasionally on the side pinnæ as well, and these are difficult to remove. In the *Angiopteris* and *Marattias* a latent bud is found at the base of the fronds. These may be taken out after the lower fronds have ripened off, but they are rather difficult to remove, and require some care to establish plants from them. Those which produce root bulbils should be grown in open baskets or on peat. The ordinary Stag's-horn Fern (*Platycerum alcicorne*) is an example of those which should be grown on peat or in a basket. Those with spreading stolons or rhizomes may be bedded-in with suitable soil round them for the young plants to root into. In many of the *Adiantums* there are numerous small crowns, and they are easily divided. The beautiful *A. Farleyense* is one of these. Old plants may be dried off a little, and all the fronds removed ; each tiny node or crown may be broken off. These bedded in sphagnum moss and sand, placed in a warm moist position, will soon start and have the appearance of small seedlings, and will require similar treatment. The *Davallias* are propagated readily from the spreading rhizomes. In dealing with each separate genus reference will be made to the most suitable modes of propagation, but finally I may add that it is always easier to deal with

fresh, healthy young plants when divisions are to be made. Where it is only from the older plants that new stock can be made, the short healthy tips of the rhizomes should be taken. Where old plants are simply cut up and repotted, they almost invariably fail to make good plants if they do not die outright.

HYBRIDS, OR GARDEN VARIETIES OF FERNS

It is extremely difficult to account for vagaries of Ferns. It has been stated that distinct forms have been obtained by cross fertilisation, yet, it would be difficult to prove how variations do really occur. Of the many varieties that have come under notice, it seems to have been more by chance than design. It was stated when we had *Adiantum Victoria* that it was a cross between *A. Farleyense* and *A. scutum*. Yet as the former has never been known to produce spores, it would seem difficult to support the theory.

Again, with *Lomaria platyptera*, this is stated to be a hybrid between *L. gibba* and *Blechnum Braziliense*. Yet it has been found among seedlings of *L. gibba*, where no plants or spores of the *Blechnum* could have come in contact with the *gibba*.

The only instance of a variety of forms coming from mixed spores which has come directly under the notice of the writer was from an accidental mixing of *Adiantums emulum* and *fragrantissima*. Whether it was from cross fertilisation or accidental variation it would be difficult to tell, yet a great variety of distinct forms were raised, some of which were very pretty, and several gained awards from the Royal Horticultural Society. Subsequent experiments with *Adiantums* and various other genera did not meet with success. Many instances could be given where very distinct varieties have occurred among batches of Ferns raised from spores in the ordi-

nary way. The *Aspleniums Mayi*, *Drueryi Herbsti*, and others were all chance variations. *Polypodium Mayi* occurred among a large batch of *P. glaucum*. In *Adiantums* it is found when raising from spores that *rhodophyllum* and *Victoriae* will occur in the same batch of seedlings. In *scutum* some will have much more colour in the young fronds than others.

It may be an interesting experiment to try cross fertilisation by mixing different species of allied genera, but unlike cross fertilisation of flowering plants, there can be no certain results.

Regarding variations, they may occur through plants being forced into growth in an unnatural manner. Instances have occurred where, in some varieties of *Pteris serrulata*, by being fed, and forced into further growth after one batch of fronds are developed, and others not ready to unfold, the pinnæ of the developed fronds will make further advance, or perhaps break out into multifid growths. All Fern growers should carefully watch those raised from spores, and any showing the slightest variations in a young state may prove very distinct when fully developed.

CHAPTER II

PREPARATION OF SOILS FOR POTTING

FAILURE in Fern culture often occurs through some slight neglect in preparation of the compost for potting. Even those which will grow in almost any soil may fail if there should happen to be something in the soil they do not like. The condition of the soil is a great factor. In the first place, it should not be too dry or too wet; if wet and sticky it clogs together when pressed, and the roots cannot penetrate freely. On the other hand, when too dry it will be very difficult to get the water to penetrate.

Temperature is another important matter. To pot even the commonest sorts in very cold soil means that the tips of the young roots will suffer, and when the points are gone it takes some time to renew them. The soil should always be as warm or a little warmer than the temperature of the house the Ferns are growing in. I believe that this is one point which is often overlooked, and if actual failure does not occur a great check is given, and it takes some time for the plants to make a new start. With the choice or tender Ferns it is of greater importance.

In referring to compost for Ferns mention is usually made to loam peat, leaf-mould, etc., but there is a great difference in the quality of these and also of manures.

Taking them in order—

LOAM.—The most suitable is a soft fibrous loam with some sand in it, but this may not be procurable, and then

some fibrous peat and sand may be added, but first of all spread the loam out and see that it is free from worms and other vermin.

The leaf mould should be well decayed, and that from Beech and Oaks is the best. It is almost impossible to get this free from worms, but if some soot is mixed with it before adding it to the other soil they may be destroyed. The black soot from ordinary house chimneys should be used. It is dangerous to use the soot from the greenhouse boilers. Manure from spent hotbeds may be used freely, or any short stable manure if it is properly dried and rubbed through a sieve. Some soot may be mixed with the manure, and if laid up for a short time the worms or worm's eggs will be destroyed.

When mixing the compost the sieve may be used for the manure and leaf-mould, but the loam should be broken up, and all the fibre retained. It is a common error to sift the compost and throw the best (that is the fibrous lumps) away.

In preparing the soil some variation has to be made for the different sorts, yet the general heap may consist of two-thirds loam and the remainder made up with leaf-mould and manure with sand added according to the texture of the loam; for those which require it peat can be added. Almost all the *Adiantums* succeed better without peat if the loam is good. For the ordinary *Adiantums*, *Pteris*, *Cyrtomiums*, etc., some bone meal may be added. This should be the pure bone meal, not dissolved bones.

Formerly peat was extensively used, but since Ferns have been so generally grown for market, it has been proved that it is quite unnecessary for most sorts, in fact they do better without it. The best *Adiantum Farleyense* I have seen have been grown in loam, manure, and sand only.

Many Ferns will succeed in almost any ordinary potting

compost, yet there is always an advantage in taking a little trouble to properly prepare it, as it may save a lot of trouble later on. One thing which should be avoided is to lay the compost on boards that may spread fungus.

POTTING FERNS

Cultural success depends largely on careful attention to small details. The soil may be properly prepared and in good condition, yet there are other matters which require consideration. The time of potting may vary considerably, and young plants of the free-growing sorts will require potting on two or three times during the year, but for the established plants of the choice sorts repotting once a year will be often enough; and the best time to do this is in the spring, after they have made a start into new growth. There may be some difference of opinion on this point. Some authorities say it should be done while the Ferns are dormant. My experience, however, has been that it is better to repot after they have started into growth. When inactive there is always a chance of the new soil getting sour before the roots penetrate it. It is the same when dividing those which have the tufted crowns; they get away much better if done after they have started into growth. Many of the *Adiantums*, which may have grown too large for their pots, may be divided, if it is not convenient to give them larger pots, and if done carefully they will not suffer from being disturbed. It may be necessary to use a knife to divide the crowns, but the roots should be pulled apart; if cut straight through some of the best, or feeders will be lost.

Taking those with a single crown, or caudex. Many of the *Pterises* and others make new roots from the stem as it advances, and some of the old roots at the bottom of the pots may be dispensed with. It will be quite safe

to cut them off above where the crocks reach, and then all the matted roots may be loosened out. By cutting away the base it will enable the plants to be potted down, so that the portion of the stem where the new roots start from can be covered with soil. Under natural conditions leaves and other materials accumulate from year to year to provide for this necessity.

Care should be taken that the soil in the pots is not too dry or too wet at the time of repotting; if it is very dry it will be most difficult to wet it afterwards, and when very wet it may squeeze up together and do mischief that way. When necessary to water, the plants should stand for a time before disturbing the roots. Size of pots is an important matter. I have frequently seen the small, delicate Ferns over-potted, while the more robust have not had pots of sufficient size.

When turning a plant out of its pot, it is easy to see what its requirements are. If the roots are chiefly on the surface, it will be evident that good drainage, and rough material for the lower part of the pots should be used; for free-rooting sorts which root down, but little space should be taken up with crocks.

With such as do not fill the pots with roots, much of the old soil may be removed and the plants potted again in the same size, or in some instances in smaller ones. It is safer to keep all weakly Ferns in rather small pots than otherwise. In the notes on preparing soils, temperature is referred to, and this must not be overlooked. Another point is that tender sorts should not be taken into a cold, draughty shed, or the roots left exposed long enough to get dry. Where the potting-shed is not connected with the fern-house, a small movable bench may be taken into the house.

Ferns do not require to be potted so firmly as many plants, yet for those which have to remain in the same pots for the whole year, the soil should be pressed fairly

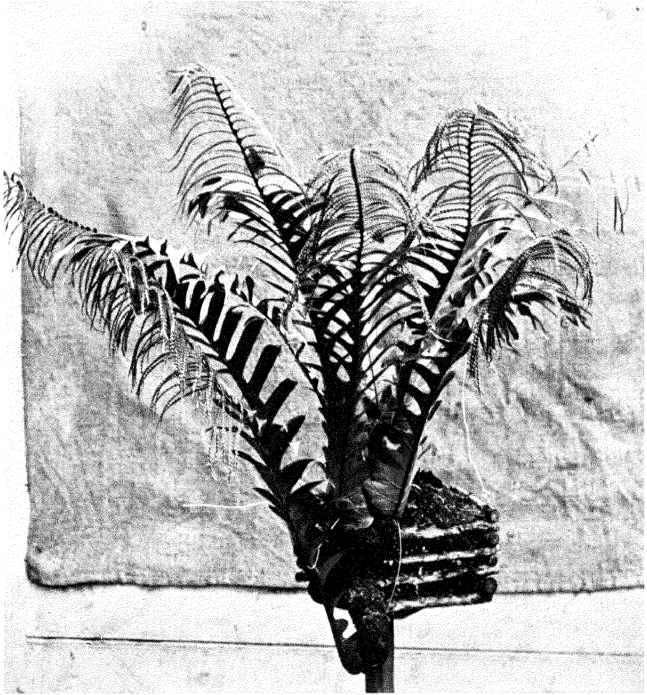
firm, especially in the lower part of the pots. I have found that the inexperienced often leave the soil loose beneath and press it too firm on the surface. After potting, the surface of the soil may be settled down by giving a slight surface watering with a fine rose watering-can. A heavy watering will wash the soil down hard, and if left until the surface gets quite dry it does not take the water so well. The slight surface watering may be all that will be necessary for some days ; much will depend upon circumstances. When it is necessary to water, sufficient should be given to penetrate to the bottom of the pots. See notes on watering.

CHAPTER III

RESTING FERNS

UNDER natural conditions most Ferns have a period of rest, and under cultivation it is an absolute necessity with some. Taking the *Gleichenias*, if they are kept too warm during the early part of the winter they may continue to grow for a time, but when the time comes for them to make their growth naturally, they will fail. The beautiful *Pteris scaberula* is sure to fail if kept warm through the early part of the winter. Most *Adiantums* if given a period of rest will start away with more vigour. Where grown for cutting from, some may be dried off early in the autumn and restarted in time to make good fronds for winter use, and these plants may be kept in heat. Yet it is those which are rested from early in the autumn until January or February and then restarted which make the most satisfactory growth. It is surprising how quickly they will make new fronds. Very little water should be given until they are well started; they may then have liquid manure.

I have found that the ordinary *Pterises* will, if rested, make better plants than those kept in heat through the Winter. It is the same with *Cyrtomiums*. And I believe that many of our choicest Ferns have been lost through giving too much warmth during the early part of the Winter. I have also found that with our hardy British Ferns, that when grown in pots they are considerably weakened if kept warm enough to make new fronds in the Autumn. The secret is that they exhaust the



POLYPODIUM (AGLAOMORPHA) MEYENIANUM
("The Bear's Paw" Fern)

vitality which should remain stored up for making growth during the natural period, and in the dull Winter months they cannot recuperate or form the strong crowns for making another start in the Spring.

There are some of our stove Ferns which are naturally deciduous (that is they lose all their fronds even when kept in warmth), and these require careful treatment. They must not be dried off too much, or exposed to a very low temperature. It is the same with the hardy deciduous sorts. Take our British Ferns: under natural conditions they get more moisture while they are dormant than they do when they are in active growth.

The *Davallias* (deciduous kinds) are the only Ferns I have found to succeed well after being kept quite dry for any length of time.

It may be pointed out that it requires some experience in regard to the time when water may be partially withheld and temperature lowered. In the ordinary course, with established plants, there will be little difficulty, as they will have naturally completed their growth and properly matured it by the Autumn, but young plants may be growing later and should not be checked until the fronds are well matured. There are many which make their fronds in whorls; and all of these may be rested, while such as have one frond following another will require more uniform treatment, and should not be subject to so great a change in the temperature. Yet a low, or comparatively low, temperature during the early winter months is beneficial to all Ferns.

WATERING FERNS

Over-watering is the most common error connected with Fern culture. Very few Ferns require to be treated as aquatics. The old practice of heavy shading and continual moisture is to some extent being discontinued,

yet there are more Ferns killed through keeping them saturated with water than from any other cause. It may, however, be pointed out that the opposite extreme may prove equally fatal. Some species may get withered and will revive again when watered, but there are others which if once they wither, can never take up water again. *Todea arborea*, *Dicksonias* and other Tree-ferns are examples. The question is often asked, "How frequently should they be watered?"

So much depends upon circumstances that it is impossible to answer. By careful observation it will soon be found easy to ascertain when water is required. One test is by tapping the pots; if they have a hollow sound water is required. In most instances the surface of the soil will indicate the condition; there is as much difference as there is in the roads when they are wet or dry. When water is required sufficient should be given to penetrate through. The temperature of water is a question on which there is some difference of opinion. From experience I should say that it is better to use it a little below the temperature of the house than above it, except in the spring when the plants are starting into active growth; and even then it should not be very much above the house temperature. If at any time they are found to be very dry, and the water does not penetrate freely, the pots should be stood in water for a time. Dipping is also the best means of properly wetting those grown in suspended baskets.

If saucers are used for standing the pots in, water should not be allowed to constantly remain in them. When standing on a moist bottom it is far better not to use saucers, except for those which take up large quantities of water, or the extra large plants in small pots. For established plants liquid manure may be used freely; that made from cow-dung and soot, if made some time before required for use and allowed to settle down so

that it can be used in a clear state, may be recommended. The soot is rather difficult to mix with the water. It is often put into the tanks in bags, but it is better to mix it in a pail, making a paste of it, and then wash it through a fine sieve into the tub or tank, it will then soon settle down.

THE USE OF THE SYRINGE.—Wall pockets which are out of reach may be watered sufficiently with the syringe, and it may be used in the way of a shower occasionally. Those who grow large quantities of Ferns for market, rarely, if ever, use it, except for wetting under the stages, etc. Frequent syringing will be almost sure to stain the fronds, and where a fairly moist atmosphere can be maintained it is quite unnecessary to use the syringe. On no account should *Gymnogrammas* or others with the powder or farina on the fronds be syringed. In the Stove Fernery if too much moisture is given during the winter it will condense on the glass and rafters, and the cold drip on the fronds will discolour them. It may be pointed out that with extra fire-heat more water may be required than in the summer, and those nearest the pipes are most likely to suffer. They are often the further away from the reach of the water-pot, and may be dry, while those nearer the front, which may be easier to examine, are moist.

CHAPTER IV

DECIDUOUS FERNS

THERE are some of our most beautiful Ferns which naturally lose all their fronds during the Autumn and remain quite dormant until the Spring; these are termed deciduous, and in some there is no visible sign of life, while others have a prominent caudex or crown. Growers not acquainted with the habits of Ferns are liable to regard those which show no sign of life as being dead, and consequently throw them away. Mistakes of this kind have come under my notice on several occasions. It will, therefore, be seen that it is of the greatest importance that those who have choice collections of Ferns should be careful to ascertain the natural habits of any that die down, before throwing them away. I may give *Adiantum lunulatum*, and *Nephrolepis Bausei* as examples where there appears no sign of life after the fronds have died off. Of the former I have found that even with quite small seedlings they will ripen off at the natural period, and come up again in the Spring. And *N. Bausei* I may mention as one which shortly after it was introduced, it occurred that a whole batch of valuable plants were thrown away by a young man who was ignorant of its habits. All of the deciduous Ferns require some care to keep them through the winter, and most of them may be kept in about the same temperature as those which retain their fronds. Of course they will not require much water, but they will perish if allowed to get very dry; it is not a

natural condition. Take our British Lady-Fern, (*Athyrium*) they usually get more moisture while they are dormant than when they are in a growing state, the driest period being (usually) when the fronds are ripening off.

The species and varieties named below may not include all the deciduous Ferns that are found under cultivation, but are among those most generally known and appreciated.

Adiantums.—Of these one of the most beautiful is *A. digitatum*, more generally known as *A. speciosum* (this should not be confused with *A. atropicum alatum*, which is sometimes erroneously named *digitatum*). It has large spreading fronds with large pinnules, which are of a soft greyish green. It requires a warm green-house or stove treatment, and should be kept fairly moist while dormant. It usually remains inactive until late in the Spring, but makes rapid growth when it does start. *A. palmatum* is of somewhat similar habit; the deep green pinnules are widely distant on very slender black stipes. This will succeed either in the stove or green-house. It should be kept in the cool-house when it is ripening off, and may be started in heat early in the Spring. *A. lunulatum* requires to be grown in baskets or suspended pots. It remains dormant for a considerable time, and the pots may remain suspended to the roof in the stove during the dormant period, or they may be placed on a shelf, and given just sufficient moisture to prevent the slender roots from perishing. *A. Henslovianum* is another distinct stove species, which grows freely but requires careful winter treatment. *Ad. pedatum*: this beautiful North American species, though hardy, is often treated as a green-house Fern, and when grown in pots should always have some protection during frosty weather. Started in a little warmth early in the Spring, it will soon develop the beautiful soft green fronds. It is a favourite Fern for growing in sheltered nooks on the rockery. *Davallia*

bullata is quite deciduous, and remains dormant until late in the spring; but while destitute of fronds, the rhizomes, which are densely covered with chestnut-brown scales, are attractive. The Japanese form "Mariesi," though considered a variety of the above, is quite distinct. The slender rhizomes have grey scales and silvery tips, and will start again into active growth almost before the old fronds have ripened off. This is well known, from being extensively imported from Japan, made up in various designs, such as Monkeys, Frogs, Birds, etc., but it is only the round balls that can be grown successfully. *Davallia immersa*, generally known as *Leucostegia*, is a most desirable Fern for baskets. The slender rhizomes spread through the soil and produce fronds as soon as they peep through to daylight, and form perfect balls of soft, almost straw-coloured fronds, with a bronzy tint. *D. pulchra* is another belonging to the same sub-genus; this does not spread so freely, and the fronds are of a deep green. All of these may be kept fairly dry during the dormant period.

Nephrolepis.—Of this genus there is only one distinct species that is deciduous; this is *pluma* and its variety *Bausei*. The latter is often given as a species, but it was originally raised from a single pinnæ of *pluma* which had produced the extended side lobes. After these are thoroughly ripened off, they may be turned out of the pots, and small tubers (as in *N. tuberosa*) will be found. These put in sphagnum moss and sand will start early in the spring, and may then be potted, either singly or about three in each pot, and grown on in the stove. *Lygodium Japonicum* (frequently named *scandens*) is semi-deciduous, and it may be cut down when the new fronds begin to show at the base. If the old fronds are left, they will die off later, and will be difficult to separate from the young ones. Other species may be treated similarly. *Atthyrium gorringeianum pictum* is a pretty

greenhouse Fern, with tricolor fronds, which ripen off early in the autumn; the plants should be kept fairly moist during the winter. This is included with the *Aspleniums* by modern botanists, but in gardens it will generally be found under the above name.

Woodsias.—There are several species of this genus which are deciduous, but some are evergreen. Those which lose their fronds should be kept in a cool position, and though they may not require much water, they must not be allowed to get too dry.

There are a good many hardy species which are deciduous, including the *Osmundas*, *Lastreas*, *Onocleas*, and others which are referred to under "Hardy Ferns."

PROLIFEROUS FERNS

It is remarkable that with many Ferns which fail to produce fertility from spores find some other mode of reproduction. Some produce plants on spreading rhizomes, others on the surface of their fronds, while many produce bulbils on their roots which, when they get through to daylight, soon make young plants.

Taking the various proliferous Ferns, it is in the *Aspleniums* that are the most prominent, yet in most of the other large genera we get some examples, and it is interesting to note how much the proliferations vary. Taking the *Aspleniums*—in *A. fœniculaceum* the bulbils rarely make but one frondlet, and will fall off readily when touched, while in most of the *bulbiferum* and *viviparum* types they cling, and are difficult to detach without damaging the fronds, and they will make several small fronds while still attached to the parent. Some are very prolific, while others produce only one solitary bilbil near the extremities of the fronds. In the *Adiantums* we have three forms of proliferation, viz. the young plants as produced on the rachis of *Ad dolabri-*

forme and *ciliatum*, the tiny bulbils as on the pinnules of *A. capillus veneris imbricatum*, and the root bulbils as on *A. Moorei* and others.

In the *Aspidiums* the proliferations mostly occur in the form of bulbils on the main rachis, and these, if the fronds are pegged down, on suitable soil will soon root, and good plants may be established before severing them from the parent; but it is difficult to get them off without damaging the fronds.

In the *gymnoeammas* we have an interesting example in *G. schuzophylla gloriosa*. This invariably produces one bilbil, or young plant, at the extremity of each frond, and in some instances the side pinnæ will also produce bulbils, and if the fronds are pegged down, young plants may soon be established. Small pots filled with suitable soil are best where there is only one bilbil at, or near the extremity of the fronds.

The *Hemiointis* produce young plants on the short fronds which lie on the surface. They root, and soon form a cluster of young plants round the parent.

In the *chelanthes* we have one example, viz. *Bergiana* (or *Hypolepis Bergiana*). Many of the *Nephrolepis* produce young plants from the spreading stolons, and others form bulbils under the soil. In the *Platyceriums* the proliferations occur on the roots, and of those in ordinary cultivation, *P. grande* is the only species which has failed to reproduce from the roots.

In the *woodwardias* we have two distinct forms of proliferation; *W. orientalis* having numerous tiny bulbils on the surface of the fronds. These stand up with one small frondlet, and when touched fall off easily. Treated in the same way as small seedlings, they soon make roots.

In *W. radicans* it is rarely that more than one bilbil is produced on each frond, and this is on the rachis towards the extremity. A round scaly bulb is first

produced, and then small fronds appear, and in this species it is very difficult to detach the bulbils without damaging the fronds; and unless specially wanted for increasing the stock, they should be left on the plants.

In the *Pterises* we have a few examples, or rather in the sub-genus *Doryopteris*, *palmata* and *pedata* are examples, but these may be more readily propagated from spores, though, usually, those which produce bulbils are slow to germinate from spores.

CHAPTER V

SMALL GROWING FERNS

THERE are many Ferns which when fully developed attain to large proportions, are equally pretty when quite small, and have the appearance of having attained to maturity. As a rule, the first fertile fronds give some indication, but this cannot be relied upon absolutely. A selection of those which are naturally of small growth may prevent mistakes in potting or planting, and also avoid those being used which would soon overgrow and smother the choice small sorts. When once planted, very few growers care to root a plant out, especially when it is growing freely, and it is not uncommon to see a large Fern overtopping the delicate small ones. Many of the small growing Ferns require to be fully exposed to the light, and under the shade of others they will gradually dwindle and die. A group of choice small species on some prominent part of the Rock-Fernery is always a great attraction; and when grown for the collection shallow pans instead of pots may be recommended. Several small plants, say one in the centre and five round it, are attractive where one diminutive specimen would hardly be seen. In making the selection it may be as well to divide them into two sections, and give a list of those suitable for the greenhouse and those for the stove separately, but there are some greenhouse sorts which succeed equally well in the stove.

For the greenhouse the following are recommended, viz.—

Adiantums.—The ordinary type of *capillus-veneris* rarely grows more than a few inches high but requires room to spread; the varieties, *c.v. daphnites*, and *fissum* form more compact masses of very short fronds. *A. hispidulum tenellum*, a pretty little Fern with brightly tinted fronds, should be well exposed. *A. venustum*, as known in most gardens, is dwarf, with spreading rhizomes. Botanists now include this with *Æthopicum*, but as there are several tall, strong growing varieties these must not be confused with the one recommended. *A. reniforme*, a choice little species with almost circular, entire fronds; *A. rubellum*, this forms a tufted mass of short fronds, which have a bright red tint changing to deep green. *A. glaucophyllum* forms a good contrast, being of similar habit with fronds of a soft pale green.

Aspleniums.—In this genus we have some very pretty small growing species. *A. ebeneum*, *A. Fernandezianum*, *A. inaequale*, *A. monanthemum*, and *A. flabellifolium* may be given, also *A. palmatum*, and *A. fontanum*.

Cheilanthes farinosa, *C. Alabamense*, a very tiny species, *C. argentea*, and *C. elegans*, though sometimes growing to a foot or more high, is a very slow grower and one of the most beautiful. Several more of these pretty Ferns might be added, but it might be difficult to procure them.

Davallias.—Most of these though they may not grow tall, spread freely. The true *D. bullata* has small fronds; *D. b. Mariese* is also of small growth and spreads freely; also, *D. heterophylla*, this is referred to with those for growing on Tree stems. *D. nova-zealandæ* must be grown in a cool, moist condition.

Doodia candata should be planted with caution, for though a pretty little Fern the seedlings spring up in all directions, and it may become a troublesome weed.

Doodia aspera multifida will succeed in the warmest part of the house but does not like a cold draught or a dry atmosphere. *Lastrea fragrans* is a very delicate little Fern, but where it can be grown it is much appreciated for it is pretty and has a pleasant scent. *L. glabella*, and *L. lepida* may be included. *Lomaria alpina*, and several other slight variations make neat compact little plants.

Notobchlenas.—These should be grouped together in a fairly dry open position. *N. Eckloniana*, though often grouped with the stove Ferns does equally well in the greenhouse. *N. sinuata*, *N. marantæ*, and any other species procurable are of interest, some have rather longer fronds but are slender, and never get too dense.

The Pelleas include some delicate and pretty Ferns. Like the preceding none make big plants. *P. ternifolia* is remarkable for the peculiar growth and bluish metallic shade on the stipes and the pinnæ which are arranged in circles instead of having a flat surface.

P. atropurpurea is another of a peculiar dark shade, *P. marginata*, and any others of the same genus, for none grow large.

Pteris.—There are several of these which belong to the sub-genus *Doryopteris*; of these *geranifolia* is a little gem, *pedata* grows rather larger, and *palmata* is still more vigorous, but this rarely attains to more than six or eight inches high. These will also succeed well in a higher temperature. *Pteris scaberula* is one of the most beautiful Ferns we have, and more resembles a *Davallia* until the spores appear. It spreads freely, having slender, wiry rhizomes, though rather difficult to establish, once it finds a congenial home it will grow freely, but rarely produces spores.

There are several small growing *Polypodiums*, these are referred to among those recommended for tree stems.

SMALL FERNS FOR THE STOVE

Among these we have some choice little gems which require very careful treatment.

Acrostichum (or *Rhipidopteris*) *peltata* is one that has tiny, much divided almost circular barren fronds, and the fertile fronds are entire and almost circular, with the whole surface covered with almost black sori. It requires similar treatment to the filmy Ferns; if not in a close case the pots may be plunged in a bed of fresh sphagnum moss, and the slender rhizomes spread more freely in a compost of peat, sphagnum, loam and sand, with plenty of drainage in which some lumps of charcoal may be used.

Actiniopteris radiata has fronds of somewhat similar form, except that the spores are on the under side of the divided fronds; it also has a crown or tufted caudex instead of the spreading rhizomes, and does not require a close, moist atmosphere.

Davallia parvula is a delicate little Fern which requires a moist atmosphere. *D. pedata*, though rare, will grow in a more exposed position. *D. Alpina* is another choice species of very small growth.

Of *Adiantums reniforme asarifolium* is all that need be included in this list. There are other dwarf growing sorts, but they all grow freely under quite ordinary treatment.

Of *Aspleniums*—*A. formosum*, *A. obtusilobum*, *A. incisum*, *A. nobilis*, and *cicutarium*, all are of fairly free growth, but like some peat with good loam sand, and good drainage.

Blechnum lanceolatum, and *B. longifolium* and *gracile*, the latter having young fronds of a bronzy red hue, and the ordinary *longifolium* rarely attains to more than nine to twelve inches high and also has bronzy fronds.

Cheilanthes radiata, sometimes known as *adiantum*, and *Nothochlana*, is a handsome little Fern in a young state,

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but with age it gets a little stunted, spores germinate freely and it is not difficult to have a succession of young plants. There are several small growing *Polypodiums*, which are equally useful for the stove rockery as for growing on tree stems; and they also do well in pans with the rhizomes regulated. As they do not root deeply, plenty of drainage is essential.

CHAPTER VI

SPECIMEN FERNS

THE very large specimens of various kinds of plants which were such a feature at our Flower Shows in years gone by, are now almost things of the past. It is true that we see some large Palms and occasionally large tree Ferns, yet the general exhibits consist of collections of smaller plants or in some cases medium sized specimens. In some shows where prizes are offered for Ferns, the size of the pots is limited to eight inches. And a larger number of fresh, healthy plants in this size is certainly more interesting than the immense specimens of former years; the smaller specimens are also much more serviceable at home, that is, for most growers. There is a wide range to select from for plants suitable for the specimens in eight inch pots, and as in most schedules it states Stove and Greenhouse Ferns some of each should always be included. From the following there will be no difficulty in making up any number from six to twenty-four good specimens.

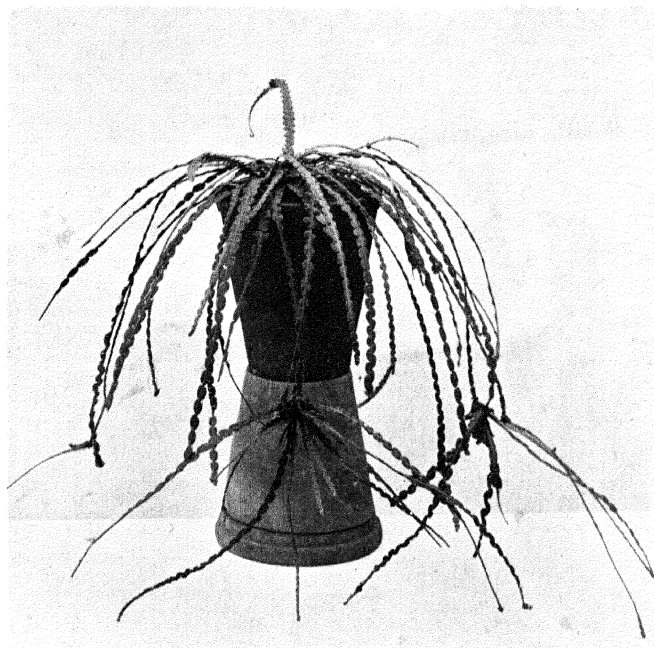
Adiantum Farleyense.—A good plant of this always counts, and grown on freely, it is seen at its best when well established as a medium specimen, though it has been grown in very large pots making fronds over three feet high. *A. polyphyllum*, perhaps better known as *cardiochlæna*, has fronds of a soft green hue with a rosy tint when young; this contrasts well with *A. trapeziforme*, which is of a darker hue. *A. pentadactylon*, which is a slight variation of the above, has fronds of an even

darker hue. These two should not be included in the same collection when exhibiting. *A. Scutum* and *A. tenerum* make fine specimens. Also *A. Williamsi*, which is decidedly a greenhouse Fern. Others may be grown into large specimens, but all should be started with fresh, healthy young plants. Good specimens cannot be made of those with a number of small crowns. *Acrostichum scandens*, better known perhaps as *Stenochlæna s.*, makes a fine specimen, the rhizomes run over the pots and the broad pinnate fronds of a bright green, with a bronzy tint when young, are very effective.

Of *Aspleniums*, *nidus* should always be included, the broad erect fronds have a bright shining surface.

This produces ærial roots round the base, and some fresh sphagnum with a little artificial manure sprinkled over it will materially assist the plants while making growth. This Fern does not root deep, and good drainage should be given or it will do better in shallow pots. The best form of *A. biforme* makes a fine plant, and if all the bulbils have been left on the older fronds they form a great attraction. *A. laxum pumilum* when grown on freely, makes a fine plant, but once it gets stunted it rarely recovers.

Blechnum Corcovadense is very pretty at its best but is not, usually, considered of so much value in a collection for exhibition as many other Ferns are. *Cibotium Scheidei* makes a grand plant, the fronds of large size are of a soft pale green above and glaucous beneath, it is of rapid growth and soon makes a good specimen. The beauty of this Fern is shown off to advantage when elevated, the under side of the fronds having a pleasant hue. In *Davallias* we now have so many of hybrid origin that it is difficult to make a selection. *D. Mooreana* is one of the oldest and still a general favourite, being equally beautiful in all sizes, but for growing on for large specimens strong rhizomes must be selected to start



LOMARIA ASPERA
(The Spider Fern)
Young plants produced on the fronds

with. *D. Fijiensis* has been productive of many fine varieties: *robusta* is one of the best for large specimens; and *solida superba*, or *ornata*, may be grown for broader fronded sorts. *D. epiphylla* is a newer introduction, the thick scaly rhizomes grow erect and the broad drooping fronds produced from them are very effective. *D. rufo* is another which makes a fine specimen, the short thick rhizomes are thickly clothed with chestnut red scales. *D. polyantha* is an old favourite and one of the few which have any colour in the young fronds.

Microlepia hirta cristata, is often seen in very large specimens with heavy fronds of a deep green, but to have it at its best it must be grown in an exposed position, and potted in light loamy soil, it is also necessary to start with strong single crowns. There are few Ferns which vary so much under different culture as this does, once it gets a dense mass of crowns it will be difficult to re-establish strong plants which produce the large drooping tasseled fronds.

Nephrolepis.—Here again we have a difficulty owing to the numerous varieties which are constantly being added, and it will be a matter of personal choice. It is not so long ago when *N. rufesceus tripinnatifida* was considered one of the handsomest Ferns we had, but now we rarely hear of it, for the beautiful nultifid forms of *exaltata* have taken its place. The old favourite, *N. davallioides furcans*, is still worthy of attention, and when grown under suitable conditions makes a fine specimen. In using the word "suitable" it may be explained that it will grow luxuriantly under heavy shade and in heat, but it is those which are well exposed and grown in loamy soil which make the best specimens. Of the bipinnatifid varieties of *N. exaltata* it is difficult to choose from, for *todæoides*, *Whitmani*, and *elegantissima* all are good, and much depends on how they are grown. *N. exaltata superba* has much to recommend it, although

it has the brown scales on the stipes and rachis which suggest its affinity to *ensifolia*, the authorities have put it under "*exaltata*," the fronds of this stand up so well.

PLATYCERIMUS.—These are dealt with under a separate heading pretty fully, and it only needs to be said that one or more of these should be included. *Grande* for choice, but *stemmaria* also makes a fine specimen, even the old *Alcicorne* may be regarded as a useful plant when well grown.

In *Polypediums* one of the finest is *P. Mayi* which is a plumose form of *glaucum* or *sporodocarpum*. There is some confusion in regard to the last two named, and it may be said that in what appears to be the true *sporodocarpum* the fronds stand erect, and the rhizomes are almost destitute of scales, while, in *glaucum* it may be described as a smaller form of *aureum* and has fronds which droop over gracefully; they all make good specimens and give a good contrast in colour among those of green shades. *P. glaucum cristatum* is also a desirable variety.

Gymnogrammas do not, as a rule, make specimens of sufficient size, yet they may, under good treatment, be grown on into large specimens with graceful fronds which are quite a contrast to the large specimens with a mass of tufted crowns sometimes seen. Of the various sorts the best golden form is *G. chrysophylla*, but of this numerous varieties occur, and for specimens it needs careful selection. *Laucbeana* is one of the best varieties. Of those with the silvery farina *G. peruviana agyrophylla* is still the best, but there are several of the sulphur tint or intermediate varieties which grow more robust and make larger fronds.

Gleichenias.—These are more difficult to manage as specimens but where possible they should be included, *G. dichotoma* stove and *G. dicarpa longipinnata*, are perhaps the best and most distinct but all may be grown into specimens, see notes on the genus. Most of the *Pteris* which can be

grown into large specimens are too common for special work. One which makes a fine specimen is *P. serrulata major gloriosa*; this is an improvement on the well known Chiswick variety. *Woodwardia radicans* makes a good specimen but takes some years to attain to full maturity.

Tree Ferns are always appreciated in collections, and those of moderate size are more decorative than the older plants with tall stems. Freshness is one of the great points which should be considered, this together with choice sorts will carry more points than size of plants.

TREE FERNS

All Ferns with erect stems (or elongated caudex) come under this heading, they vary considerably both in height and size. The smallest is the brightly tinted *Lomaria L'Herminieri*, and the species making the largest or rather highest stem is *Dicksonia antarctica*. We get them from the tropical and temperate regions, and it is remarkable that none appear to be indigenous in Europe; the nearest we have is the Royal Fern (*Osmunda Regalis*), which is found in Devonshire with the caudex from a foot to eighteen inches long and nearly if not quite erect. And like many of the tree-ferns it delights in a moist boggy position, or the banks of a running stream with the tips of the roots in the water. Of all the various species the most popular is *Dicksonia antarctica*. This though attaining to a height of 20 feet or more and producing fronds from 4 to 5 feet long and about 2 feet broad, is equally desirable in a smaller state. Seedlings about a year old make pretty little plants. The largest plants from English raised seedling that I have seen have been from four to six feet high, and these must have been a good many years old. The very tall stems are imported from Australia, where they grow luxuriously on the mountain slopes. We hear of them being covered

with snow, but the cold period is only of short duration, and to succeed with it here it requires greenhouse treatment, with atmospheric moisture. This and other tree-ferns may be considerably assisted by binding some fresh sphagnum moss round the stem below the fronds as the stem advances. The use of sphagnum round the pots may also be recommended, and during the growing season the stems should be kept continually moist, but they do not thrive if the roots are in stagnant moisture; good drainage should be given. Other species are *D. fibrosa*, *D. Lathomi*, and *D. squarrosa*; the latter has a slender stem and does not make the aerial roots so freely. *Alsophila Australis*, and *A. excelsa* make fine specimens; *Cyathea dealbata* and *C. medullaris* may also be recommended. *Blechnum Braziliense* makes a fine plant of intermediate size and is also desirable as a small plant. *B. corcovadense* differs from the above only in having a beautiful pink tint on the young fronds, and may be regarded as the most desirable of the two.

Brainea insignis is another of medium growth. I have not seen this more than about three feet in height; it has fronds of good substance, and, when young, they have a bronzy tint. *Lomaria gibba* will attain to five or six feet in height, but is prettier either when quite small, or up to the time the stem has reached about two feet in height. Up to the time it has made some stem it will grow freely under ordinary greenhouse treatment, but after the stem lengthens it requires more care. There are several distinct varieties of this fern. Of these *platyptera*, *robusta*, and *crispa* are among the best; there are also some which appear to be hybrids between *gibba* and *ciliata*, of these *grandis*, *princeps*, and *major* are the best, though given as varieties of *Ciliata* they have some of the characteristics of *gibba*. *L. falcata bipinnatifida* makes a beautiful plant with feather-like fronds. I have raised this from spores and have had some true

to character, but they vary very much; the only sure method is to root the offsets from the stem. *L. attenuata*, which has soft green fronds with a rosy pink shade when young, can be propagated in the same manner. Sphagnum moss with some sand mixed with it, if bound round the base, will secure some roots before taking the young plants off from the parent. Although the Tree-ferns love atmospheric moisture below, most of them will bear exposure to the sun, and heavy shading is injurious, especially during the Autumn.

CHAPTER VII

FLOWERING FERNS

THE term "Flowering Fern," though not strictly correct, is commonly applied to those which have their fructification disposed in a conspicuous manner, and include the *Anemias* and *Osmundas*, as described below. The *Anemias* and *Anemidictyons* are now all included in the first named genus. These all have pinnate fronds with rather long stipes (or stalks). The fructification, or fertile portion, being confined to the two lower pinnæ; these are rather elongated and grow erect, and being destitute of the leafy green have all the appearance of flower spikes. They require rather careful treatment, and under the best conditions they get rather shabby with age, and seedlings should be raised to keep up a succession of healthy plants. The spores should be collected as soon as the fertile portion begins to change colour, and will germinate freely under ordinary treatment. In growing the young plants on, they will be more effective if several are potted together, but they should not be crowded up in a bunch. They should be given a light porous compost and good drainage. They may all be grown on in a stove temperature, but after being well established, *A. phyllitidis*, which is also known as *fraxinifolia*, will do well in a greenhouse, and will survive the winter when planted in a sheltered position on the rockery, yet it is safer in the unheated greenhouse. *A. tomentosa*, also known as *ferruginea* and *flexuosa*, though

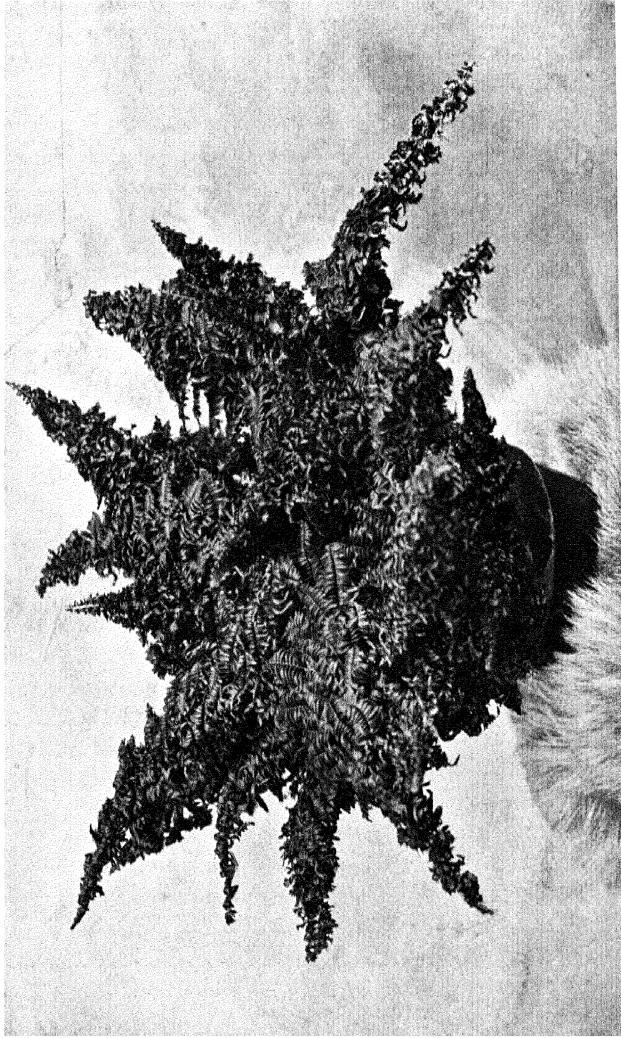
usually included with the stove species, will succeed in the greenhouse.

Of those which require stove treatment *A. collina* is one of the most desirable. The stipes and surface of the fronds are densely clothed with short brownish hairs. *A. rotundifolia* is remarkably distinct, and at first sight reminds one of *Adiantum lunulatum*. The drooping pinnate fronds have an elongated extremity from which young plants are produced. The fertile portion is produced in the same manner as the other Anemias; the fronds have a bronzy-brown tint when young. This should be grown suspended, and young plants may be established from the bulbs at the extremities of the fronds, which may be rooted into small pots before severing them from the parent plant. *A. Dregiana* is a pretty, small-growing species with woolly fronds; the fertile portion is not quite so much extended as in most species. There are several other species which are not often met with under cultivation. This may be due to the fact that they rarely live for more than two or three years, and require treating as annuals.

OSMUNDAS.—These are nearly all deciduous, and in most of them the fructifications are on the terminal pinnæ of the fronds. The largest species is our native Royal Fern, *O. regalis*. In this the fronds attain in size according to age. They may have fertile fronds when not more than fifteen to eighteen inches high, but older specimens grow to three or four feet, and form a hard, woody trunk. The North American *O. gracilis* varies very much in size, and also in the colour of its fronds. Among imported plants, we find some of a soft green, and others with dark rachis and stipes and a red tint on the young fronds. This is described as growing luxuriously in swampy places, where it covers large tracts of land. A friend, writing, speaks of it as being seen as abundant in North America, as our Bracken is here in

England. *O. palustris* (or *Japonica*) closely resembles *gracilis*, except that it is not quite so hardy, and is evergreen. It is one of the most desirable ferns we have; the young fronds have bright rosy stipes and a bronzy shade on the leafy portion. *O. Javanica* is another evergreen species; in this the spores are produced irregularly on the side pinnæ. *O. Claytoniana* is another which has some leafy pinnæ above the contracted fertile portion; in *cinnamomea* the fertile fronds stand erect in the centre of the plant.

The *Osmundas* all delight in a rather moist position, and should have fibrous or a boggy compost. They make roots above the surface, or what are termed ærial roots, which derive nourishment from surface moisture, and delight in moist sphagnum moss, applied at intervals, with a little artificial manure sprinkled amongst it. Although they like moisture, stagnation must be avoided, and they should be fully exposed to the light, and no moisture on the surface of the fronds should be given. *O. Javanica* is the only species requiring much warmth. *O. palustris* will grow freely in heat, and will also succeed under cool treatment. Other species are hardy, but should have some protection such as is provided in a natural state, by their own decayed fronds, during frosty weather. There are several other species which might be included in this chapter. The curious little *Rhipidopteris peltata* is an example; the barren fronds are much divided, and nearly circular, on slender stems, and the fronds have two small, nearly circular, lobes, with the spores covering their surfaces. This requires similar treatment to that given for the stove filmy ferns. There are several others belonging to the same order, *Acrosticheæ*, in which the fertile fronds are congested and the spore cases conspicuous.



CHEILANthes EXALTATA VAR. SUPERBISSIMA
From F. K. Pierson & Co., New York

CLIMBING FERNS

There are not a great many which are of a distinctly climbing habit. The *Lygodiums* are the most prominent, but it is not an extensive genus. There are about six useful species, and of these *L. Japonicum* is the most popular, and is grown extensively for market, both for cutting from and as pot plants. Previous to having the *Asparagus* in long trails, and the *smilux*, it was much in demand, and even now it is appreciated, and for the Fernery, for covering pillars, there is no prettier subject. I may here state that for a long time this was known in nurseries as *L. scandens*, but the true *scandens*, though a pretty Fern, is not so useful. *L. dichotomum* is of much larger proportions, and will grow to a great length, twining round any support that comes in its way. *L. microphyllum* and *L. palmatum* are slender growing. The latter comes from America, where it is very popular, being used both in a dry state and also fresh cut for decorations.

In the culture of the *Lygodiums* they all require some attention. To keep the scandent fronds in order they must be regulated. *Japonicum*, when grown for cutting from, should have strings; a wire run along about five or six feet above the pots, and slender strings brought down and fixed with a peg into the pots. Once started from the base, the slender growths will twine round without much attention; but if they get entwined together, it will be very difficult to separate them. As pot plants they may be grown on a single stick, or three sticks put in close to the rims of the pots and tied together at the top. In the Fernery, standing above the dwarfer sorts, they make a nice relief. Where space permits, *L. dichotomum* should be planted out.

Rough fibrous loam, leaf mould, to which may be added a liberal addition of coarse sand, and a little well-

dried stable manure, is a compost in which they will thrive. Some recommend peat, but if the loam is fibrous it is not necessary.

For the slender growing sorts good drainage should be given. Some are semi-deciduous, and if the old fronds are cut away just as the new ones begin to start it will save much trouble later. This applies particularly to *Japonicum*. The plants may be kept cool during the winter, and when given a little warmth early in the year they soon start to throw up young fronds from the root-stocks. They should be kept fairly moist, otherwise thrips may be troublesome.

Stenochlæna scandens.—This is a free-growing Fern with rather large pinnate fronds produced on fleshy rhizomes at some distance apart. Grown on a moist wall it is very effective, and it is also a useful Fern for large baskets. In large Fern Rockeries it may be planted at the base, and will spread rapidly. It will not bear exposure quite so well as some, but will grow in any ordinary Fern compost. When growing freely they will require regulating, and it may be necessary to fix the rhizomes to the wall. For a large space, where the wall has been covered with moss, etc., it makes a fine show.

Davallia aculeata may be included in the list, but it requires some support, and it is rather difficult to grow successfully.

Davallia heterophylla may also be treated as a climbing Fern, though it is more suited for covering tree seams, under which mode it is referred to.

CHAPTER VIII

FILMY FERNS

AMONG those included under the above title, we have many widely-distinct Ferns, but all have one characteristic—that is, their fronds are semi-transparent, and all delight in a moist, cool atmosphere. It is probably owing to the fact that they require exceptional treatment that they are not more generally grown than they are, for under favourable conditions they grow freely and are peculiarly attractive. There is also the advantage of not having to provide heat. The lovely *Todea superba* may have the globules of water on the surface of their fronds frozen into ice without doing any harm.

Their chief requirements are a close, moist atmosphere, and for this reason they may be specially recommended to be grown in glass cases, and will do well in the house, as they require only a moderate amount of light and must not be exposed to the sun. When grown extensively, a deep grotto may be formed, with a glass roof, and if this can be done under a north wall, all the better. The sides may be built up with rough sandstones, porous bricks, or tufa stone may be used, with spaces for old tree roots, rough peat, and sphagnum moss; old tree fern stems cut up, and some leaf mould, may be added. The finest plants of *Todea superba* I have seen were growing round the sides of a deep pit built of bricks, with a glass covering. Here the large plants were luxuriating, and numerous seedlings were springing up among them.

As a proof of the hardships the filmys will go through, I may mention that I once received some imported clumps of *Trichomanes reniforme*, and although they had been a considerable time on the journey they had suffered but little, and after being put into pans with suitable compost (which consisted of rough peat, broken crocks, charcoal, sphagnum moss, and small stones), placed in a close, shady position, they soon started into new growth, and continued to grow freely. *Todea pellucida* did not succeed quite so well, but some survived the journey, and good plants were established.

Although there are a good many distinct species, they are all included in about three or four genera. The *Todeas* make larger plants. The most beautiful is *T. superba*, which has a tufted caudex, and a regular whorl of fronds which are tripinnatifid and cut up into very narrow segments. It is difficult to describe the exquisite beauty of this fern. *T. Fraseri* is another beautiful species, which has fronds from one to two feet long, and of rather more substance than most of the filmys; and belonging to the same genus is one with very thick fronds. This is *Tobea barbara*, also known as *arborea*, *Africana*, *Vromii*, and *rivularis*; this is not included with the filmies, but flourishes best where the roots find plenty of moisture.

Trichomanes radicans (The Killarney Fern) is one of the best types of this genus, and is found in England, but in some localities it has been exterminated. It is, however, more common in Ireland, and widely distributed over other parts of the world. There are a good many species of this pretty filmy Fern. *T. reniforme* is a very distinct species, forming large masses of deep green, nearly circular, entire fronds, which are produced from slender, spreading rhizomes; *T. angustatum*, *T. trichodium*, and others, with small fronds cut down into fine thread-like filaments. *T. Javanicum* has a more tufted caudex and erect pinnate fronds. All of those

with the spreading rhizomes should be planted where they can spread over moist sandstones or other material that the roots can cling to. They require but very little depth of soil.

The *Hymenophyllums*, which include the Tunbridge Wells Fern (*H. tunbridgense*) was formerly more plentiful in the neighbourhood of Tunbridge Wells and also in other parts of England, but is rarely found in a wild state, except in Ireland. There are a good many species, and most of which are nearly if not quite hardy. Nearly all have spreading rhizomes and very fine thread-like roots, which do not penetrate far, and only require a shallow depth of loose decayed leaves, peat, and moss to root into. Although loving moisture, good drainage should be given, and some charcoal may be used. They are particularly suited for spreading over the stones of the rock Fernery, but some soil, chiefly leaf mould and moss, should be used in the crevices.

CHAPTER IX

TINTED AND VARIEGATED FERNS

IT is usual to regard Ferns as having only sombre hues of green, yet it is remarkable what bright tints may be developed under proper treatment. Before enumerating the varieties, it may be remarked that with almost all which give colour, light and exposure are essential. Observation will prove that those which are of a deep green like more shade, while those with the red, or bronzy tints, may be exposed to the sun; and it is only when well exposed that they develop the brightest hues. Take the beautiful *Adiantum Farleyense*. Under shade it will grow and make fronds of a deep green, yet when started and grown on with little or no shade the young fronds will have a soft salmon pink shade, and the plants may be used for decorations and will not suffer so much as those grown under shade. One of the brightest tinted Ferns is *Adiantum tetraphyllum gracile*. This requires stove treatment, and is rarely seen, but it is one of the most beautiful Ferns we have. *A. Veitchi* is another which colours well, the young fronds being almost as bright as *Dracena terminalis*. *A. macrophyllum* colours well, and the variegated variety is remarkably bright. *A. macrophyllum bipinatum* has rather more of a bronzy-brown shade, though when quite young it is very bright. *A. scutum roseum*, *A. rubellum*, *A. tinctum*, and *A. cyclosorum* colour well. The colour of all the above, though very bright when the fronds are young, gradu-

ally changes to green with age. *A. hispidulum tenellum* and *A. rhodophyllum* may also be included.

In the *Davallias* we do not get much colour, *D. polyantha* being an exception; this has quite a purple shade in the young fronds. There is also a bronzy tint in some varieties of *D. Fijiensis*. *Blechnum corcovadense* is very brightly tinted even when quite young. *Doodia aspera multifida* has a bright rosy-red tint, changing to deep green. In the *Gymnogrammas* we get the golden and silver tints.

There are a good many varieties of *G. chrysophylla*, *grandiceps superba* being one of the best. In *G. Alstonie* the pinnules curl inwards, and show off the golden under surface. The best Silver Fern is *G. pemviana argyrophylla*, and of this there are several variable forms. *G. wettenballiana* is the best crested form. *Lomaria L'Heriniera* is one of the most beautiful of all the tinted Ferns.

Lastrea erythrosora, *L. varia*, and *L. opaca* are brightly tinted. In *L. aristata variegata* we have one of the best variegated Ferns.

Leucostegia (Davallia) immersa gives a pale straw green, with a bronze tint when young, but this has a darker green shade when not fully exposed to the light.

Osmunada palustris forms a striking contrast to our English Royal Fern (*O. Regalis*), as the fronds are bright rosy tinted when young and change to deep green.

In the *Polypodiums* we have several distinct shades. *P. appendiculatum* is of a deep bronzy shade, while in *P. sporadocarpum* we have a soft glaucous shade, with a bluish metallic tint, yet most of this genus have green fronds.

In the *Pteris* we get the most distinctly variegated forms. *P. tricolor* is one of the most beautiful Ferns we have. It has a beautiful red shade when well grown. This rarely makes a large plant, and over-potting must be avoided and the fronds must not be wetted. A cold

drip from the roof will cause discolouration of the fronds. *P. nemoralis variegata*, in addition to the white linear variegation, has a rosy tint in the young fronds; while in *P. argyrea* the white linear marking is more decided, and the green of a very soft shade. *P. cretica albo-lineata* is now more popular than formerly, and there are several good crested forms of this; *Alexandra* is one of the best. *P. Victoriae* and *P. Regine* are good variegated Ferns, but when raised from spores they vary considerably, and there are some pretty crested forms of these Ferns. *P. aspericaulis* is of a dark bronzy tint. *Doryopteris nobilis* is one which must be included.

The above is not quite a complete list of the variegated Ferns, but it includes most of those under ordinary cultivation.

CHOICE FERNS FOR THE STOVE

Some of our most beautiful Ferns are of little service except to be grown in the stove. A long list of choice sorts might be given. Those named below are among the most effective. In the *Adiantums* there are many varieties. *A. curvatum* is one of the most beautiful, of medium size, with curved pinæ. It has spreading rhizomes, and requires a light porous compost. The surface of the fronds should be kept quite free from moisture. This does not come freely from spores, but may be increased by divisions.

A. macrophyllum bipinnatum.—This is another beautiful Fern which has failed to reproduce from spores, though what appear to be good fertile fronds are produced in abundance. This has spreading root-stocks, which may be divided. For dividing the choice sorts the best time is in the spring, after they have started into active growth: great care must be taken not to expose them to the cold or allow the roots to get dry, and the compost

must be as warm as the temperature of the house where the Ferns are growing.

Onychium auratum.—This is a most beautiful Fern, with very finely cut fronds. A very short exposure to the cold will cause the fronds to discolour (or turn black). It is curious that the yellow spore masses which are produced in such great abundance, nearly always prove abortive. I have raised some seedlings, yet the only really good batch I ever had was from a small portion of a fertile frond received from India. As this Fern rarely has but a single crown, it is only from spores that it can be propagated. And it may be added that *Onychium Japonicum*, which is nearly hardy, though producing spores very sparsely, they germinate freely, and this Fern may also be propagated by divisions of the spreading rhizomes.

Asplenium marginatum.—This is a beautiful and distinct species, but very tender. It has large pinnate fronds of a beautiful soft pale green. It can only be propagated from spores: these germinate freely. It was from spores from an old botanical collection of dried specimens that it was re-established in this country after being lost for some years. This Fern will withstand a little cold better than it will a dry, arid atmosphere. It also requires careful attention to watering.

Acrostichum aureum.—This is another distinct stove Fern, with long pinnate fronds of a thick fleshy nature; it may be regarded as a semi-aquatic, for it does best when standing over a tank where the tips of the roots can touch the water.

Acrostichum osmundaceum is a very distinct Fern. Before the fertile fronds appear it has the appearance of being allied to *Polystichum coriaceum*, but the fertile portions of the fronds are congested and covered with spore cases. The fronds are produced from thick scaly rhizomes.

Hymenodium crinitum.—This is by some authors included with the *Acrostichums*. It has broad entire (undivided) fronds covered with rather long brown hairs. These are produced from a single crown, which is covered with brownish scales.

Gymnoogramma schizophilla gloriosa.—This, though referred to elsewhere, should be included here, as it is only in the stove where it is seen to advantage.

Marattia Cooperi is a Fern rarely seen, which makes a fine plant when grown under favourable conditions in the stove. It should be potted in good loam, and may be increased by the offsets which will come from the base of the matured fronds; it will be found a little difficult to sever them, and it is best to put some sphagnum and sand round for them to root into before taking them off.

Davallia tenuifolia Veitchiana should be included in this list. It is one of the most beautiful of the genus, and should be found in all choice collections.

Doryopteris (Pteris) nobilis is another grand stove Fern, which requires rather careful treatment.

D. ludens may also be mentioned as a most distinct and attractive species. The barren fronds are broad and of irregular shape: those producing spores are palmate, and have longer stipes.

CHAPTER X

FERNS FOR HANGING-BASKETS

THERE is no better way of growing many Ferns than in hanging-baskets suspended from the roof of the Fernery, and in this manner their fullest beauty is developed. I could give a long selection of varieties suitable for the purpose. For those to be grown fully exposed to the sun and light, the *Nephrolepis* are the most suitable. I can only mention a few here. The most popular is *exaltata*, known in America as "The Boston Fern." For larger baskets, *ensifolia*, which will make fronds fully six feet long, may be recommended. The newer varieties, such as *todæoides*, *elegantissima*, *Fosteri*, and *Whitmanii*, are all suitable. For smaller baskets, *pectinata* is one of the best, though it is not quite so hardy as *Philippinensis*, which is also a slender form, but has not quite such a light drooping habit. *Davallioides* is a beautiful Fern with very long, drooping fronds, but only suitable for the stove. *Goniophlebium subauriculatum*, when suspended in the stove, will make fronds fully six feet long; in fact, under genial conditions, the same fronds seem to continually extend. *Asplenium longissimum* is another which can only be grown in a suspended basket. This, I may mention, should have some peat or light soil. I have seen it with fronds (hanging down) which were fully eight feet long. *Asplenium caudatum* is a similar species, and perhaps the most desirable, as it will grow freely under cooler treatment, and is one of the prettiest Ferns we have for baskets. Any of the bulbiferous section do well in baskets; the

best for the purpose being *flaccidum*, and for small baskets *obtusilobum* is a pretty species. This makes long, slender stolons (or runners), like a strawberry, on which young plants are produced.

In *Adiantums* we have some which make very pretty basket plants. *A. assimile* is one of the best. *A. Moorei*, perhaps better known as *A. amabile* by many, is another fine basket Fern, but has the disadvantage of being semi-deciduous. For small baskets, *A. ciliatum*, also known as *Edgworthi*, and *A. dolabriforme*, are very pretty, producing young plants at the extremities of each frond, and these young plants will go on reproducing again while they are on the parent. When hung in a position where there is heat and a little atmospheric moisture, they make very pretty subjects for hanging-baskets. There are many other *Adiantums* which do well; even *A. Farleyense*, if properly treated, makes a handsome Basket-Fern.

Many of the *Davallias* are particularly suited for the purpose, for where the rhizomes can spread they soon cover the whole surface. Among the best are *D. dissecta*, *D. decora*, *D. bullata*, *Tyermanni*, and *Griffithiana*. The Japanese variety of *bullata*, known as *Mariesi*, though deciduous, is one of the best. The new fronds are produced very soon after the old ones have died off. *D. immersa* (more generally known as *Leucostegia immersa*) makes a pretty Basket-Fern: this is deciduous, and remains dormant all through the winter. The rhizomes will run all through the soil, and even when grown in pots, if they can get through the bottom, they will do so and make fronds.

Gymnogramma schizophylla gloriosa is a very handsome Fern, but only succeeds well in the stove.

Platycerium alcicorne (the ordinary Stag's-horn Fern) may be recommended. It may take some time, yet when the roots do get through, young plants will

soon cover the whole surface. *P. Willincki* is another fine fern for the purpose.

In filling fern baskets it is necessary to use some moss; the thin flakes are the best. If too much is used, the soil becomes loose after it decays a little. For those with the spreading rhizomes, sphagnum should be used.

For the *Nepbrolepis*, and any others which do not cover the under side of the baskets, a few young plants of *Ficus repens* will soon make a nice green covering.

Water may be given more liberally to Ferns grown in hanging-baskets, and where convenient the best manner is to dip them in a tank or any other receptacle large enough to do it without damaging the fronds.

FERNS FOR WALL POCKETS

Walls are sometimes built with special bricks, which form troughs for planting Ferns in: it may be less trouble and more convenient to make pockets. They can be formed of virgin cork, fixed on boards of suitable length to form the backs, or may be made wholly of the cork. Select flat pieces for the backs, and the curled or half-circular pieces cut to form the pockets; when properly fixed together with wire, the pockets will last for a long period; they should be made in sizes suitable for the various Ferns used, and the selection will depend upon the space they have to cover. Any of the *Adiantums* which have spreading rhizomes may be used. On a shady wall in a cool-house the varieties of *capillus veneris* do well; the varieties *Mariesi* and *O'Brieni* grow larger than the ordinary type, and, where space permits, do well; *magnificum* and *imbricatum* are the best of those, with shorter fronds; *A. assimile* is a pretty species, which spreads freely; *A. amabile* (or *Moorei*) is another

which does well; many of the *Davallias* do well; *D. dissecta* is one of the best for the purpose; *D. Tyermanni*, which has long silvery rhizomes and small dark green fronds; and *Mariesi* do well in an intermediate temperature. For the warmer house, *Griffithiana* spreads freely, and the rhizomes, with silvery gray scales, are very conspicuous. *D. Assamica* is another. The numerous varieties of *D. Fijiensis* are all useful; they vary much in size, and with some the rhizomes are shorter. *D. ornata* makes larger fronds, and has spreading rhizomes. Others might also be selected. The *Platycteriums* are referred to elsewhere, but it may be mentioned here that they should always be used when it is desired to cover a wall attractively. For larger pockets, *Stenochlæna scandens* is a fine Fern. *Asplenium longissimum* makes very long, drooping fronds, and does well when hanging against a wall. *Asplenium caudatum* is similar in growth, but has rather broader fronds, and the pinnae are deeply serrated. *Nephrolepis davallioides* is another which makes very long drooping fronds. Most of the other species may also be recommended. *Goniophlebium subauriculatum*, when suspended, does well. In the Fernery at the Royal Gardens, Kew, some years ago there was a plant hanging against a wall which had fronds fully six feet long, but it is not often that such specimens are seen. Any of the Ferns mentioned among those recommended for suspended baskets will succeed in the pockets.

When filling the pockets, fresh, healthy young plants should be selected rather than large plants, which, though giving an immediate effect, do not succeed so well later. With those having a tufted crown, two or more plants may be used for each pocket. Sphagnum moss should be used to fill up any crevices where the cork does not fit close; and it may be mentioned that it is an advantage to have some openings for those which produce young plants from the root bulbils.

With the hanging pockets watering will be an important matter. More attention will be required than for those grown in pots, and though excess must be avoided, with ordinary treatment they will not be likely to suffer from over-watering.

CHAPTER XI

FERNS ON TREE STEMS

THERE are many of the slender-growing Ferns with spreading rhizomes which may be most effectively shown when grown on straight or branched tree stems. These may be of various heights and dimensions. Where the dead tree-fern trunks can be procured they are the most serviceable—hollowed out at the top—for putting in a good plant, and the stem covered with sphagnum moss, with which may be mixed a little peat and sand. This, bound on with fine copper wire, will provide good material for the rhizomes to root into. In preparing ordinary tree stems, a receptacle may be provided at the top by fixing a few split hazel rods. These may come down the whole length of the stem, and the space between will give more room for the moss, etc. The size of the stems should be regulated according to the growth of the Ferns they are intended for.

Another method which may be recommended for those requiring more root-room is to form cork pockets on the stems. A matter of importance is to fix the stems on a good base. They are often fixed in flower-pots, but as these are liable to get broken, it is better to use tubs of suitable sizes, or a good base may be formed by fixing the stems on a thick piece of wood, and about three brackets screwed on the stem and base to keep it firm; the base may be built up with soil and moss, on which may be planted some of the mossy *Selaginellas* or

Ficus repens; or small erect growing Ferns round the base make a nice finish.

Taking the most suitable sorts—any that have the spreading stolons, or rhizomes, may be employed. Among those particularly adapted for the purpose are *Davallia heterophylla*. This will soon cover a fairly large stem. *Davallia pedata* is suitable for a short stem. *Davallia parvula* is a lovely little Fern. A stem about 18 inches high will suit this best, and it loves a moist, shady position and a moderate stove temperature. The *Drymoglossums* are all suitable. Of those specially useful are *piloselloides*, *carinosum*, and *spatulatum*. These may have stems from two to three feet in height. Many of the *Polypodiums* might be named. Of those specially suitable are *venosum*, *squamulosum*, *nitidum*, *glaucum*, *serpens* (often seen in gardens under the name of *Niphobolus rupestris*). There are also several usually found under the name of *Pleopeltis*; of these, *piloselloides*, *repens*, and *vaccinifolium*. Of the last-named there is a variety *album*, with silvery grey fronds. All spread freely, and soon cover a moderate-sized stem.

Niphobolus heteractis will cover a fair-sized stem, but does not spread so rapidly as some. *Asplenium abscissum* and *A. obtusilobum* should have short stems. The last-named forms young plants on spreading rhizomes, much in the same way as strawberry runners are produced.

There are several *Adiantums* which may be recommended. Among them, any of the *capillus veneris* varieties, *imbricatum* being one of the prettiest, *dolabriforme* and *ciliatum* (also known as *Ghiesbreghtii*)—they both form young plants at the extremities of the fronds, and these will again extend even when hanging down without anything to root into, but they do better when pegged on to the moss-covered stems.

For a larger stem, *Nephrolepis pectinata* may be recommended, and there are also several others of this genus that would do well. The *Platycteriums* are more suitable

for the large-branching stems. For these, cork pockets may be fixed at the top of each branch. They will grow without much soil to root into, but if peat sphagnum and a little fibrous loam is used they will not be so liable to suffer from drought. Several sorts may be used on the same stem; the long, drooping fronds of *Willincki* are most effective. The ordinary form of *alcicorne* may also be recommended for the main stem, and *Æthopicum* (*stemmaria*) fills up well.

THE ROCK FERNERY

Many Ferns succeed much better when planted out than they do if confined to pots, and a well-built Rockery provides for the requirements of numerous widely distinct species. The first thing is to build the Rockery up so that there can be plenty of room for soil, with suitable pockets or fissures for planting those which require plenty of root-room. There must also be good provision made for drainage. In regard to material for the Rockery some sand-stones should be used; brick burrs, clinkers and some lumps of chalk may also be used. Old root stumps will be suitable for some of the *Poly-podiums* to spread over. The prominent points should be provided with small pockets for the *Cheilanthes*, *Nothochlenas*, small-growing *Davallias*, *Pelleas*, etc. Many of the small-growing Ferns, though they may like a little shade, do not succeed well where they are overtopped with large plants, but some of the most shady nooks may be planted with *Selaginellas*. *Pteris scaberula* in a cool position where there is a fair amount of light makes a pretty mass of its finely cut fronds. *Davallia Nova Zelandie* is another which must have a moist, cool position.

One of the most important matters in planting a Rockery is to avoid putting those which make rapid growth where they will overgrow the choice small

species. It is the knowledge of the habits of Ferns that is of such great importance when planting; for many of the large-growing sorts have the appearance of being fully developed while they are quite small. One guide is that in many Ferns the appearance of fertile fronds indicates that they will not get much larger, but this is not always reliable, for some have fertile fronds in an early stage, and others fail at any stage to produce spores. It is only by experience that the habits of various species can be ascertained. When grown in pots they can easily be transferred, but some of the most beautiful Ferns do not like being disturbed after they are established on the Rockery.

It may also occur that a good many Fern weeds may spring up and choke out the choice sorts. Of all Ferns *Nephrodium molle* should be avoided, for once this ripens its fertile fronds, seedlings spring up in all directions. *Pteris tremula* is almost as bad. *Gymnogramma Martensi* is another troublesome weed.

It is often owing to the want of a little attention that choice Ferns are lost. When they have been planted for some time there may be some which will require more fresh soil round the crowns. With the deciduous sorts on the outside Rockery the old fronds should be left on to protect the crowns. Slugs and snails often prove great enemies on the Rockery, and must be looked after. Inverted pots with any kind of green vegetable under them make good traps. It will save much trouble if they are caught before the Ferns start to make new growth in the Spring. The tiny black slugs are the most troublesome indoors, and if not watched they do much mischief, the *Aspleniums* will suffer most. They will eat the young fronds through just as they begin to uncoil, and *Adiantums* often suffer very much. For these small black slugs, carrots, potatoes, or turnips cut in slices and laid about make good traps.

CHAPTER XII

FERNS FOR WINDOW BOXES

FOR any shady position there is no other class of plants which succeed better than Ferns. The boxes should be properly prepared by giving good drainage, and for all that will succeed, good loam may be used for filling them. A little leaf mould may be added, also some stable manure, which has been used for a hot bed or has otherwise been well rotted, and if the loam is heavy a little sharp sand may also be added.

Taking the varieties most suitable, our British *Scolopendriums* and the *Polystichums* succeed well, but some Exotics may be used. *Pteris serrulata* and *Pteris cretica*, including their numerous varieties, will live through the Winter, unless it is exceptionally severe. *Cyrtomium falcatum* is another which keeps its fronds all the Winter, and there are several fine varieties of this, but I should recommend the old type as being the hardiest. The *Adiantum capillus-veneris* may be used for an edging, but this will probably lose its fronds during the Winter. The numerous beautiful varieties of *Asplenium* (*Athyrium*) *filix-fœmina* are pretty, but, losing their fronds early in the Autumn, cannot be recommended; yet, where the effect is only desired for the Summer, they may be planted. The *Lomarias* (*Blechnums*) *spicant*, and other varieties, are very pretty, and are evergreen, but they do not succeed so well under cultivation; they seem to love the sunny slopes in woods, where they are fed by the accumulation

of leaves and the running water from the higher ground, and here occurs one point which applies equally to many Ferns, that is, though thriving in moisture, they do not like stagnation; and in regard to those planted in window boxes, water should be given very liberally, so that it passes through, and to some extent cleanses the soil, and then no more should be given until it is getting dry again. Here it requires some discretion, but the most ordinary observer can tell if a plant is withering or the soil is getting too dry; and the great secret of success is to avoid continual saturation of the soil, and at the same time see that it does not get too dry, yet of the two it would be of less harm to Ferns for the soil to get too dry than to be always soaked with water.

When once established, the same plants would do service for several years. A little of the top surface of the soil might be removed annually and replaced with some fresh, which might have a little of any of the ordinary artificial fertilisers added to it, but avoid the strong fish manure; natural guano is perhaps the best to recommend. Coming to this reminds me of an incident in my earliest experience of Fern growing. I had argued that, under natural conditions, Ferns received much manure from birds and animals, and, by way of experiment, started using guano on a small batch, with the result that its effects were soon seen. It depends much on the time the manure is used. Never give it when the plants first become dormant; but use it just before, and while the plants are in active growth. Also avoid using it until the roots are well established in the new soil, especially when using it as a liquid, for nothing sours soil so soon as liquid manure when there are no roots to take it up. While being a strong advocate for manure, I would say that, like all other good things, it does harm if used in excess.

FERNS FOR HOUSE DECORATION

At one time those considered suitable for this purpose were limited to a very few sorts. The *Cyrtomums* (in the markets often called the Holly Fern): this is undoubtedly one of the most serviceable. There are several varieties of *falcatum*, that known as *Fensomi* being one of the best. *Pteris serrulata* (the Ribbon Fern) is another one, and of this we have a great many varieties. The crested forms are not so popular as they were formerly, but it is quite a matter of individual taste; they all do well. *Pteris cretica* is another, and of this we have some good variegated varieties; of which, *Alexandra* is one of the best, but the ordinary *cretica albo-lineata* remains a favourite. Of the green forms, *major* is the best large-fronded variety; in crested sorts, *Wimsetti* is one of the best. *Pteris tremula* is another old favourite; there are several slight variations; they all are useful.

The *Nephrolepis* are among those which have become popular more recently: *exaltata* is the best type, and all the varieties with multifid growths do equally well. If taken from a hot, moist position they would go off quickly, but as grown for market they last well. Other sorts do equally well; for this purpose it is only when they are grown in a light, airy position that they are likely to be of service. In *Aspleniums* we have several that last well: *biforme* is an old favourite, and within the last few years *nidus* (the Bird's-nest Fern) has become a popular variety. *Polypodium (Pbledodium) aureum* is another that may be grown for the purpose, but this will not stand a very low temperature so well as those referred to above.

I did not intend to include any *Adiantums* in this chapter, but those who want more variety may try them: *tenerum*, or the variety *scutum*, are good; *elegans* is much hardier than the ordinary *cuneatum*

(or Maidenhair Fern); and the varieties of *capillus-veneris* do well, but do not grow tall enough to be very effective.

Platyceriums are all useful. The ordinary *P. alcicorne* (or Stag's-horn Fern), I find, lasts wonderfully well, and though not yet quite a popular market Fern, it will last in the house as long as any, and is always admired when seen in good condition.

Among hardy sorts, the *Scolopendriums*, of which we have numerous varieties, and the *Polystichums* (*Aspidiums*) of the *angulare* type, of which there are also many beautiful varieties, do well in a window where there is little sun.

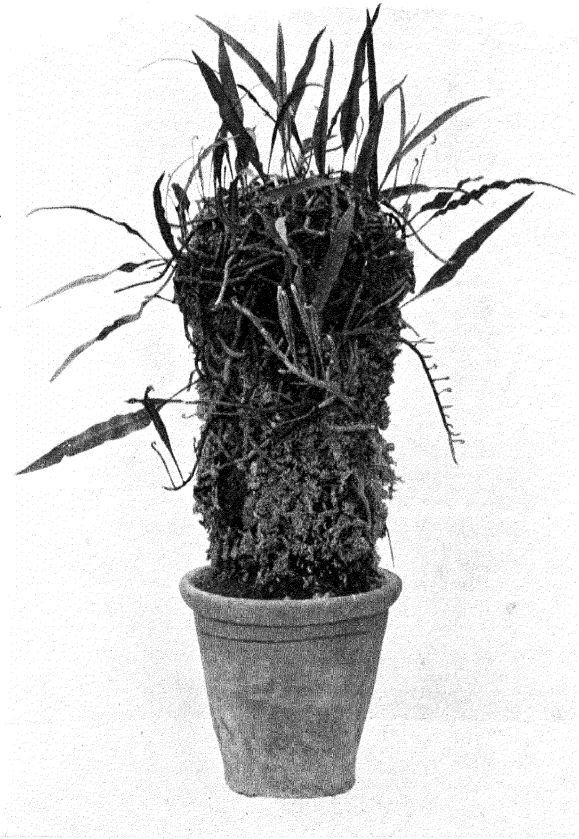
The great fault with many who have Ferns indoors is that they over-water them. It is easy to go to the other extreme. My experience has taught me that it is difficult to give advice on this subject, for while amateurs may read, they do not follow the instructions. I have frequently been told that plants which have shown definite evidence of having been too dry, have been watered regularly, and, on the other hand, I have found that many water Ferns too much. There are more Ferns spoiled from injudicious watering than from any other cause. When required a thorough soaking may be given, and then they should be left to get fairly dry before more is given. I have had plants submitted for my inspection where the soil has been thoroughly soured through over-watering; and I have also had others which, though the soil was wet on the outside, in the centre it proved to be as dry as dust. Frequent dribbles is the greatest mistake made.

CHAPTER XIII

ADIANTUMS

THE popular Maidenhair-Fern is known to almost everyone, yet few know that there are so many widely distinct species of the same genus. In Hooker's "Species Filicum" over a hundred species are described, and in addition to these there are numerous garden varieties. They are found in all parts of the world, and vary from those with simple (or undivided fronds) to those cut up into numerous sub-divisions. Some have close tufted crowns, while others have rhizomes which spread freely. Some are quite hardy while others require a stove temperature. For convenience it may be as well to divide them up into several groups. I will first take simple fronded, or RENIFORME GROUP. This consists of *Ad. reniforme*, a most interesting little Fern from the temperate regions. It is generally included in the greenhouse Ferns, but I have found it do better under warmer treatment. The variety *asarifolium* has larger fronds and shorter stipes (or leaf-stalks). I have raised both from spores, but have found them difficult to establish. *Ad. Parishii* is the only other species with undivided fronds, and I have not seen this except in dried specimens; I believe it is not in cultivation in this country at the present time.

MACROPHYLLUM GROUP.—These are mostly pinnate or bipinnate. *A. macrophyllum* is one of the most popular we have; it can be raised from spores and grown in the stove where it is well exposed to the light; the young



POLYPODIUM VENOSUM
Grown on tree-stem

fronds have a beautiful rosy-pink tint. There is also a very pretty variegated variety of this, *A. macrophyllum bipinnatum*, a most distinct Fern with longer stipes, and fronds standing nearly erect; this has a beautiful bronzy-brown tint in the young fronds. *A. peruvianum* is a handsome Fern with large arching fronds; the large pinnules are loosely arranged on a spreading rachis. The above all require stove treatment, and should be potted in a rough porous compost, consisting largely of fibrous loam, with some manure, leaf mould, and sand. Avoid over-potting.

PROLIFEROUS GROUP.—The species which produce bulbils on the fronds are confined to those with pinnate fronds. Of these *caudatum* has long narrow fronds of a silvery grey, and a young plant is produced at the extremity of each frond. *A. ciliatum* (or *Edgeworthi*) is more prolific; the young plants will again produce another generation, or perhaps a third may be grown—all hanging down from the parent. *A. dolabriforme* is of a deeper green and equally prolific. *A. lunulatum*, a deciduous species, has larger pinnæ and long, drooping fronds. After losing the fronds this should still be kept in a warm house, and not allowed to get too dry in the pot. All of these are very pretty when grown in pots suspended from the roof, but they do not make large plants.

POLYPHYLLUM GROUP.—I may include a good many in this section. The species *polyphyllum*, also known as *cardioclæna*, makes a fine plant of soft pale green with a pretty tint of bronzy-pink when young. *A. curvatum* is a handsome species; *A. tetraphyllum* and its varieties of which *gracilis* with its deep red-tinted fronds is one of the best, but very rare. *A. trapeziforme*, *A. pentadactylon*, *A. Neo Caledonicum*, and *Æthopicum alatum* (or *digitatum*) are all showy species.

CUNEATUM GROUP.—This is the most interesting,

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taking the well-known Maidenhair Fern as the type; there are many others closely allied to it. Though still grown extensively, the variety *elegans* now takes its place in many instances; it is hardier, and will grow freely through the Winter. *A. cuneatum grandiceps* is a beautiful Fern, but requires careful culture, and should be suspended so that the terminal crests of the drooping fronds can be properly developed; *decorum*, *Weigandi*, *fragrantissimum*, *gracillimum*, *Fergussoni*, *Regina*, and *Williamsi*, are all useful. Of compact growing sorts, *Pacotti*, *mundulum*, *Le grandi*, *rubellum*, *tinctum*, and *Versaillense* (crested) are among the most desirable.

TENERUM GROUP.—These have larger fronds. The type is one of the best we have, and to this is attached *A. Farleyense*, which is considered the queen of all Ferns. *Ads. Lathomii*, *scutum*, *Bessonianum*, and *Bausei*, a variety of the type with deflexed pinnules.

HISPIDULUM GROUP.—With these we may include *fulvum*, *hispidulum*, *hispidulum tenellum*, and *setulosum*.¹

CAPILLUS-VENERIS GROUP.—In addition to the indigenous species and its varieties, we have *A. Mariesi*, from Japan, *A. O'Brieni*, from South Africa. The best varieties of the indigenous species are *imbricatum*, *cornubiense*, and *magnificum*.

Other useful *Adiantums* are referred to in chapters on those suitable for special purposes.

ASPLENIUMS

In these we have an important and variable genus, those of the "bulbiferum" type being the most useful; and here I may remark that though what appear to be good spores are abundant, it is rarely that they germinate, though it is easy enough to establish young plants from the bulbils, which may be treated in the same way as young seedlings. Of these the most useful sorts are

bulbiferum, *biforme*, *Colensoi*, *viviparum*, *laxum pumilum*, *inaequale*, and *flaccidum*. To these may be added *caudatum* and *longissimum*, each of which have very long, drooping fronds, with one or two bulbils at their extremities. These make fine basket Ferns for suspension. I have seen the latter with fronds over six feet long hanging down from suspended pots. Of sorts which do not produce bulbils, *Baptistii* and *Neo-Caledonicum*, with *pteridoides*, have given us some good varieties. It is difficult to be quite decided on the parentage, but *Mayi*, *Herbsti*, *incisum*, *Drueryi*, and *grandis*, all come from one or the other of the above. *A. nidus* has been extensively grown during the last few years, and is found very serviceable for ordinary decorations, besides being one of the most distinct Ferns we have for including in any collection; *lucidum* is another useful species, and though raised from spores has given no very distinct variations, but I have seen some a little inclined to become crested; *marginatum* is one of the most distinct. This has large pinnate fronds of a pale green, the texture being very soft, which is quite the opposite of the previously named, that being of a thick, coriaceous texture. Of small-growing sorts, *formosum*, *fragrans*, *cicutarium*, and *palmatum* are distinct.

Most of the Aspleniums succeed best in a rough fibrous compost, and for those which show the roots on the surface, peat and sphagnum moss may be used.

CHAPTER XIV

ASPIDIUMS

IN this genus botanists now include many Ferns, which were formerly known under separate generic names. Those generally known as *Aspidiums* do not form an important group, only about six species being given in most nursery catalogues, yet in Hooker's "Synopsis Filicum" over fifty are given. Of those most generally known under the generic name, *A. trifoliatum* is one of the most useful; there is also a larger form, known in gardens as *A. macrophyllum*. *A. viviparum*, which has the surface of its fronds studded with tiny round bulbils, is also a popular species. Those generally known as *Cyrtomiums* come next. *C. falcatum* and its improved varieties are among the most popular and easily grown Ferns we have. *C. Fortunei* and *C. caryotedium* may also be included among desirable Ferns for a cool greenhouse. All of these succeed best when potted in good loam, with some manure added. When growing young plants on, they may have warmth, but must not be subject to a very dry atmosphere, for thrips are particularly partial to these Ferns. A cool bottom with a little warmth above, and no dry draughts, will ensure good growth. It may be added that there are few Ferns which are more benefited by the application of liquid manure. The plants kept quite cool during the Winter, and given some warmth early in the year, make most satisfactory growth. The *Polystichums* are better known under the old name. *P. coriaceum*, or *P. Capense*, and *P. setosum* are the most

useful for greenhouse culture. The hardy species and varieties are referred to, with other hardy Ferns. In the *Lastreas* we have many useful species. *L. aristata variegata* has long been one of the most popular Ferns for the greenhouse, or for decorations. Its only fault is that it is rather slow in a young state, and two or three plants should be grown together in each pot. The fronds are of good substance, with a bright green surface, and a distinct lineal marking of creamy white. It is of dwarf habit, but most useful, as it stands so well when used for decorations. The ordinary green form, which grows rather taller, is also a useful Fern. *Lastrea patens* is another favourite; this has pinnate fronds, of a graceful drooping habit. *L. lepida*, of similar habit, with very narrow pinnæ, makes a handsome plant. *Lastrea erythrosora*, referred to in another chapter. *L. Standishi*, *L. opaca*, and *L. varia* are all useful species, which succeed well in the greenhouse or cool Fernery. All may be raised from spores, but they are slow to germinate compared with most other Ferns, and they do not make rapid progress during the early stages, but once established they last well. They all like a good loamy compost, and rather cool treatment; in much warmth thrips are sure to be troublesome.

CHEILANTHES

Several of these are referred to in the notes on small-growing Ferns, yet there are a few, though not of large growth, could not be included. Of these, *C. hirta Ellisiana* is a most desirable Fern; it has pinnate fronds from one to one and a half feet long, with a woolly surface, and the stipes covered with brown scales or hairs. *C. elegans* (the Lace-Fern) is a most elegant species; this seems to do equally well in the stove as the greenhouse; the very finely cut fronds have a soft silvery

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grey surface; this is more effective when three or four plants are grown together in each pot, and a light, sandy compost should be used for potting. There are several other species of medium growth, which succeed well under greenhouse treatment.

CHAPTER XV

GLEICHENIAS

THE species included in this genus are not numerous, and all are of similar habit; their fronds, which are produced from thin wiry rhizomes, have the peculiarity of extending for an indefinite period. After the first pair of frondlets are developed a bud is formed, which later extends, and another pair of frondlets are developed, and this goes on. Formerly some of the species were grown on into large specimens, and the fronds trained round balloon trellises.

It is remarkable that in New South Wales some species grow and spread as freely as our common Bracken (*Pteris aquilina*), and form tangled masses which are difficult to penetrate, and the soil in which they grow so freely appears to be a heavy loam. Yet when cultivated in this country they succeed best in a compost consisting of peat, leaf mould, and fibrous loam in equal parts, with sand added, and good drainage. Although they like plenty of moisture, stagnation must be avoided. They succeed best when fully exposed to the light, with air above and a damp moist bottom. Under heavy shading they will soon show signs of weakly growth, and gradually dwindle away. Temperature is another important matter. Too much warmth, especially during the Winter, is sure to prove fatal. *G. dichotoma* is the only species which requires any warmth, and even this may be grown under cooler treatment than is generally given, and requires a period of rest during the Autumn. All other species must be grown under cool greenhouse

treatment, but though a little frost may do no harm, it is safer to keep the temperature above freezing-point. In dividing plants up to increase the stock they require very careful handling. Young plants may be divided into two or three, by cutting the rhizomes and then pulling the roots apart. Or with larger plants the rhizomes may be left to spread over the rims of the pots, and rooted into small pots before severing from the parent. It is curious that although they prove so troublesome to some growers, with others they grow as freely as weeds.

It is remarkable that we have no garden varieties, the few variations we have are introductions. Being propagated from divisions may account for the absence of varieties; it is very rarely that they are propagated from spores. All the known species are worthy of attention, but in a limited collection. *G. dicarpa longipinnata*, *G. Mendelli*, *G. semivestita*, *G. rupestris*, and *G. rupestris glaucescens* should be included.

DAVALLIAS

In this genus we have numerous distinct species, and many pretty garden varieties. With few exceptions they have fleshy, spreading rhizomes, most of which are covered with hairy scales, which vary in colour from silvery-white to nut-brown. In many, the rhizomes are a most attractive feature. As they spread freely, shallow pots or pans are most suitable for their culture; they also succeed well in baskets suspended from the roof, and are among the prettiest Ferns for the Rockery.

When raised from spores they make more compact plants, and in quite a small state are very pretty, but most of them are rather slow to make a start. They may be readily increased by the divisions of the rhizomes. The compost most suitable consists of fibrous loam, peat, coarse sand, and good drainage, and some rubble or small crocks may be mixed with the compost. Charcoal may also be used.



PLATYCERIUM GRANDE
Grown on cork
Taken at Messrs. H. B. May & Sons' Nursery

When potting, the soil should be kept well above the rims, and raised in the centre so that the rhizomes can spread over; many of them will soon cover the outer surface of the pots. After potting, a surfacing of sphagnum moss worked among the rhizomes will be an advantage, but is not absolutely necessary.

Taking the sorts, all that are found enumerated in any catalogue are pretty, but I should make the following selection for a limited collection, viz.: *Canariensis* (the true Hare's-foot Fern), *dissecta* (for covering baskets), *Fijiensis* and its numerous varieties are all most elegant for pots. *D. bullata*: this is deciduous, but the nut-brown rhizomes are pretty even when there are no fronds. The Japanese variety of this, *D. Mariesi*, has more slender rhizomes, and silver-grey scales, and a great variation is seen among seedlings. *D. epiphylla*: this is a distinct Fern, the rhizomes growing nearly erect, and has rather large spreading fronds. In *D. feniculacea* we have a very distinct Fern. It has a tufted caudex, and more the appearance of an *Asplenium* in general habit. Then in *D. aculeata* we have a climbing Fern; this is rare, but where well grown it is very pretty. Among the sorts most conspicuous for the silvery rhizomes are *Tyermani* and *Griffithiana*. These both make very long rhizomes, and if grown in suspended pots or baskets will soon cover the whole surface.

D. tenuifolia does not spread, but has erect fronds. The variety *tenuifolia Veitchii* is one of the prettiest slender-fronded Ferns we have. *D. Mooreana* (or *pallida*) is another with a tufted caudex, and makes a fine specimen for exhibition.

Other distinct species are now added to this genus. *Leucostegia immersa* is one. This is deciduous, and the rhizomes spread freely; for baskets it is one of the best we have.

CHAPTER XVI

GYMNOGRAMMAS

IN this genus we have many distinct species, of which the silver and the gold Ferns are the most remarkable. At one time these were all that were included, but now the *Dictyogrammas*, which have thick fleshy fronds and are destitute of the powder (or farina) on their surface, and of quite a distinct appearance, have been added. All of the *chrysophylla* and *Peruviana argyrophylla* type succeed best in a compost of fibrous loam, peat, leaf mould, and coarse sand. A little manure may be added. All of those with the powder on the fronds should be placed in such a position that in watering the fronds do not get wetted. It not only spoils the appearance of the plants, but also covers others with the powder. Elevated on pedestals or inverted pots they show the gold or silver under surface better, and also succeed more satisfactorily under such conditions. There are very few Ferns which suffer so soon if allowed to get too dry; at the same time over-watering is equally injurious. Taking the varieties, *G. chrysophylla* is the best type of the golden Ferns, but the garden varieties are now numerous. *Alstonia* has the pinnules curled inwards, showing the under surface to advantage; *chrysophylla grandiceps superba*, the best crested form; in this both the under and the upper surface of the fronds are covered with the golden-yellow farina, and it is one of the prettiest we have.

In the silver varieties there is nothing better than the best type of *Peruviana argyrophylla*, which is covered on

both surfaces with white powder. *Wettenballiana* varies, but the best type is the prettiest crested silver form. There are several intermediate varieties of both the silver and golden Ferns. Then we have *G. schizophylla gloriosa*, a splendid Fern for suspended pots or baskets. This has long, drooping, finely-cut fronds, and produces bulbils, or rather young plants, on the extremity of the rachis, and in some instances I have seen the young plants on the side pinnæ. One of the most useful for a cool house is *G. Martensi*; the surface of the fronds is a bright deep green, with a slight yellow powdering beneath. There is no other Fern which comes more freely from spores than this, and it often proves a troublesome weed where choice Ferns are sown. There are numerous other pretty varieties of the gold and silver Ferns. Taking the other distinct species, that known generally as *Dictyogramma Japonica* and the variegated variety are both useful, especially the latter. They are nearly, if not quite, hardy, and may be increased by division or from spores. In warmth they are evergreen, but under cool treatment they lose their fronds in Winter. Like most other Japanese plants, they start into growth early in the Spring, and if exposed are liable to suffer from Spring frosts. *G. caudiformis* is another, with thick leathery fronds, and *elliptica* is also worthy of mention. It may be noted that those belonging to the *Dictyogrammas* are totally different in appearance to those of the ordinary type of *Gymnogrammas*.

NEPHROLEPIS

This is not an extensive genus, but all the known species, of which there are about a dozen, are worthy of cultivation. And during the past few years many beautiful varieties have been added. It is not many years ago that market growers in this country and in

America took up their culture for market, and they have proved so valuable that at the present time there are no other Ferns receiving more attention. The greatest advance is found in the crested and multifid varieties of *N. exaltata*, the original species, which in America is known as the "Boston Fern" or "Bostonensis," either as a pot plant or for suspended baskets there is no other Fern that is more appreciated. It is remarkable that this rarely comes true from spores, yet we have many varieties, which are, chiefly, sports. *N. Piersoni* was one of the first of these, and was introduced from America only a few years ago. When first introduced it was the admiration of all Fern-lovers, and is now extensively grown, but we have since had many further improvements. In the Spring of 1906 we had *N. elegantissima*, another American variety. Then in the Autumn Messrs T. Rochford & Sons gave us *N. Todaeoides*, which is one of the most beautiful we have. This was raised at Messrs Rochford's Nurseries. And in the Spring of 1907 we had *N. Whitmani*, another with multifid feather-like fronds. *N. exaltata superbissima*: this is the latest introduction from America; it is a very dense plumose form. The plants which arrived in November 1907 gained a first-class certificate from the Royal Horticultural Society; there are also others being added. The last two named varieties appear to be the best. Then we have *N. Scotti*, which is more compact than the type. In the crested varieties *N. superba*, which is given as a variety of *exaltata*, but which appears to be more nearly related to *ensifolia* or *rufescens*, is one of the finest. This came from Messrs H. B. May & Sons, who have given us several other good varieties, *N. pectinata caniculata* being one of the most remarkable. The fronds grow nearly erect, the pinnules, which curl back towards the point, each have a tuft of hairy filaments on the surface.

Several good crested varieties have been raised from

the old favourite *N. davallioides furcans*. This, which was one of the first of those with multifid growths, still retains the specific name of *davallioides*, yet the seedlings have been included under *N. exaltata*. The true *N. davallioides* is a handsome Fern with long drooping fronds; the pinnæ are narrow and longer than in any other species, the fertile pinnæ being slightly contracted, and the spore cases close on the margin. *N. ensifolia* is a grand Fern for large baskets, making fronds from four to five feet long. This is sometimes named *acuta*, but is quite distinct, the latter having more erect fronds of bluish metallic tint and a black rachis; though a very distinct species it is not of so much value for ordinary culture as most of the species. *Nephrolepis cordata compacta* makes a compact plant with rather short, erect (or nearly) fronds of a deep green. *N. cordata tessellata* (which was raised by Messrs Pricket & Sons) has bipinnatifid fronds, and the side pinnules continue to elongate. *N. Duffi* is a very distinct species, but is only suitable for the stove fernery. *N. pectinata* makes long, slender fronds with short pinnæ of a pale green, and is one of the best for smaller baskets or wall pockets. *N. philippinense* has rather narrow, deep green fronds, and will do well under cooler treatment than most species. From Messrs May & Sons we have some remarkably curious congested varieties; of these *crispato-congesta* grows only a few inches high, the fronds stand erect, and the twisted pinnæ overlap each other. *Mayi* is of similar growth but much larger, making fronds from nine to fifteen inches high. *N. rufescens* (or *Zollingeriana*) is a distinct species with rather broad, nearly erect fronds, the stipes and rachis being covered with brown woolly scales. The variety *N. rufescens tripinnatifida* makes a very handsome plant, the fronds, which stand erect, have a beautiful feathery appearance, and attain to from two to three feet in height. This beautiful variety has been

rather neglected since the plumose varieties of *exaltata* have been introduced. It requires growing on freely from the young plants produced on the stolons; with age the crowns get weak and the fronds do not develop their full beauty. *N. Fosteri* is an American variety which has long drooping fronds with narrow pinnæ, and when properly developed they are bipinnatifid, but it is not always that it comes true; it is one of the most desirable for baskets.

CULTURE.—All the *Nephrolepis* may be potted in good rich loamy soil, and may be kept in active growth throughout the year. Most of them may be readily increased from the young plants produced on the slender spreading stolons. *Cordata* is one which comes freely from spores and shows but little variation, but with seedlings of most sorts they are a long time in coming into their true character, and also show much variation.

Although the *Nephrolepis* thrive best in a stove temperature, they will last well in quite a cool house after they are well established, and will even do well out of doors during the summer. All the plumose and crested varieties, also others with drooping fronds, do best when suspended from the roof or elevated on pedestals. When grown fully exposed, with just sufficient shade to prevent the fronds from burning during the hottest part of the summer, they make fronds of good substance and of a pleasing shade of light green. When under shade and heat they will grow freely, but the fronds will be soft and of a dark sombre green. There are few Ferns vary so much under different modes of culture as do the *Nephrolepis*. All the free growing sorts may be liberally supplied with manure after they are well established; it may be used frequently, but should be of only moderate strength.

CHAPTER XVII

PLATYCERIUMS

THERE are only about seven or eight distinct species of this curious and interesting genus, but we now have several distinct garden hybrids. They may all be treated as epiphytes, that is, they may grow on tree stems or blocks of wood. Yet they succeed better when some peat leaf mould and sphagnum moss is provided for them to root into; the decayed dorsal fronds provide some material for the roots, and if an old plant is pulled to pieces roots will be found spreading between the decayed barren fronds which spread shell-like round the pockets or tree stems to which they are affixed. In their natural habitats they get some assistance from decayed leaves, the excrement from birds, etc. And though they may grow for a long period without any other assistance except that derived from their own decayed fronds and moisture, they succeed better when given some further assistance. It is rather surprising that these curious Ferns do not come into more general use for decorations, for they are most tenacious of life and will survive under conditions in which most plants would perish. I found on one occasion they were the only plants which had survived in a neglected conservatory, and I have a plant before me now which has been in the house a little over a year and is looking as healthy as when it first came.

P. alcicorne and its varieties are the most generally useful; this is commonly known as the Stag's-horn Fern,

and may be grown as a pot plant, in baskets, or in cork pockets. When grown in pots a stump of wood should be put into the pot and brought up a little above the surface so that the barren basal fronds may cling round it. In an open basket the roots will spread and young plants will soon appear from the bulbils which are formed on the roots. *P. major* and *Hillii* are two of the best varieties, but recently there has been others added, which may prove of value. It may be as well to note that this is the only species which makes satisfactory growth under cool treatment, but in addition to being found growing in the temperate regions of Australia, it is also found in Madagascar and other warm regions, and will succeed equally well in the stove as in the greenhouse.

P. Willincki is a distinct species. The barren fronds stand erect and are lobed, the rather long fertile fronds hang down, are cut into irregular lobes, and are of a peculiar grey shade. This also produces plants from the root bulbils, but not so freely as in *Alcicorne*. *P. grande* is well named, for it is one of the most noble Ferns we have. The broad, shell-like, barren fronds will spread fully three feet, and in well-developed plants the fertile fronds, which are pendulous, may reach over three feet in length. This is the only species which fails to produce bulbils on the roots, and can only be propagated from spores. The spores should be sown on a mixture of finely-chopped sphagnum, peat, and sand, which should be pressed down to make a smooth surface. The lower portion of the seed pots may be filled up with loam, only a thin surfacing of sphagnum, etc., being necessary. Seedlings are very slow, and after they are well established it may be some years before fertile fronds are produced. *P. Æthiopicum*, also known as *P. stemmaria*, which comes from Central Africa, is another noble species. The large barren fronds grow erect, while the fertile ones, which are broad and usually

have two broad lobes, or in larger plants each broad lobe may again be divided into two smaller ones. Both barren and fertile fronds are produced in pairs, and the older ones die off as the new ones appear. *P. Veitchi* produces flat, almost circular, basal fronds, and those which produce spores stand nearly erect, and are clothed with a pale grey woolly substance. *P. angolense*, *P. Wallachii*, and *P. biforme* are rare species, which are not of much service except for choice collections. I may add that the last named is not now in cultivation, but from dried fronds it appears a very distinct and handsome species. *Æthiopicum* is sometimes sold as *biforme*, owing to the fronds being two-lobed.

POLYPODIUMS

This is a most extensive and variable genus, including species of widely distinct appearance. There were formerly upwards of fifty sub-genera, which modern authors now include with the typical genus; but for garden purposes it is more convenient to keep most of them under the names they have long been known by. There are some exceptions. Those formerly known as *Phlebodiums* are now generally included under the typical name; yet here we have a difficulty, for the small-growing *P. glaucophyllum* is likely to be confused with *P. glaucum*. Then there is another wide distinction. In some the fronds are adherent to the caudex (or stem), while in others, with the spreading rhizomes, the fronds when ripened off, fall, leaving only a scar on the rhizome.

Considering that there are (according to Nicholson's "Dictionary of Gardening") upwards of 450 species, it is difficult to make a selection; but taking those of the most value for decorations, *P. aureum* and its varieties are among the best. In the type we find some variation among seedlings. The best form has large fronds, and

makes a fine decorative plant. In the markets it is often called the Hare's-foot Fern, on account of the thick, woolly rhizomes. *P. glaucum* is of more slender growth, and has a beautiful blue, metallic shade to the fronds. *Mayi* is a beautiful plumose variety of this. *P. sporodocarpum* is another distinct variety; in this the rhizomes are almost destitute of the woolly scales, and the fronds stand erect. *P. nigrescens* is very distinct; the stipes and rachis are almost black, and the spore cases are sunk, the surface of the fronds having regular lines of nodes on each pinnule of the fertile fronds. *P. irioides* has long strap-shaped fronds of a thick leathery texture. *P. appendiculatum* resembles our British species, except that the fronds droop over and have a reddish, bronzy shade. This is generally included under *Goniophlebium*, and *subauriculatum* comes under the same sub-genus. This has long, drooping fronds; suspended in the stove fernery, it will extend fully six feet. This should be grown in a rough compost, and some peat may be used.

P. quercifolium is a curiously distinct species. The barren, or basal fronds, are broad and only slightly lobed, much after the shape of a large oak leaf, while the fertile ones are long, and divided into narrow lobes nearly down to the mid-rib.

P. meyenianum (known generally as *Aglaomorpha m.*) is a very distinct species, having a thick, brown, woolly rhizome, broadly lobed fronds, of thick texture, the fertile portion being on the terminal pinnules, which are much contracted; it makes a fine basket fern. *P. Schneideri* is a remarkable variety of garden origin, in a young state the fronds have broad lobes only, but in older plants they are large and much divided. It appears to be related to the *vulgare*, and though it may be hardy it succeeds best in a cool house, and leaf mould, peat, loam, with plenty of sand, should be used for potting.

There are many of the sub-genera, such as *Pleopeltis phymatodes*, and others, with spreading rhizomes, are particularly suited for planting on the rock-fernery.

Most of those with the spreading rhizomes succeed best where there is plenty of moisture and like good drainage; sphagnum moss, leaf-mould, with a little loam, should be used for planting or potting them in. Many will do well without any extra warmth during the summer, but if the temperature falls low during the winter the fronds will lose the bright healthy colour, or may go quite discoloured. They are most liable to suffer if they have been kept very warm and then suddenly exposed to cold. Liquid manure may be used freely for all the strong-growing sorts, but the artificial fertilisers should be avoided, as they are liable to burn the rhizomes.

CHAPTER XVIII

PTERIS

THE species generally cultivated under this generic name are not numerous, but there are a great many garden varieties, and there are several sub-genera which botanists now include, yet for garden purposes they retain the distinctive generic names, *Doryopteris* and *Litobrochia* are examples.

Taking the ordinary species as known in gardens, *P. serrulata* is one of the most popular, and of this there are a great many varieties. The ordinary type, which is known as the "ribbon fern," has long, narrow pinnæ, and of this there are many pretty crested varieties. *P. serrulata major* grows from two to three feet high and makes a fine specimen. There is a crested form of this known as the "Chiswick Variety," which I have seen with fronds standing fully four feet high. There are also many intermediate varieties. *P. cretica* comes next, and it is rather difficult to divide the two species, for, since garden varieties have been so numerous, they appear to have been intercrossed, the chief characteristic of *Cretica* is that the fronds are shorter and broader. In this we have a major variety, or rather there are several slight variations under different names. *Ouvrardi* is one of the best. In the crested varieties *Wimsetti* is one of the most popular. In this the pinnæ have a terminal crest, and are also cut down into narrow segments on the lower portion of the side pinnules. And there are now several improved varieties. The

variegated variety *P. cretica albo-lineata* is an old favourite, and of this we have some pretty crested varieties, the best of which is *Alexandra*, but *Mayi* is still extensively grown. *P. Victoriae* is a pretty variegated form, and of this there are several variations, of which *Reginae* and *Reginae cristata* are among the best.

It is hardly necessary to refer to *P. tremula* as it is so well known. There are several varieties, including *Smithi*, a well crested form, and *flaccida*, which has narrow pinnules with a bright surface.

P. argyrea is one of the prettiest of the larger growing variegated Ferns.

P. longifolia and the variety *Mariesi* are useful.

All of the above are suitable for growing in a moderate temperature, and may be potted in a loamy compost to which a liberal addition of manure may be added. And liquid manure may also be used freely after the pots are filled with roots.

The choicer sorts, such as *P. tricolor*, *P. aspericaulis*, *P. nemoralis variegata* and others, may be given more warmth, and do better in a compost consisting of fibrous loam, leaf-mould, with a liberal addition of sand and some manure from a hot bed or other stable manure that has been well dried.

Of the sub-genera *Doryopteris* is the most important; *D. palmata* is a useful Fern for decorations, but *nobilis*, *Duvali*, *sagitata* and others are only suitable for choice collections, and require similar treatment to that recommended for *tricolor*, etc.

Of the *Litobrochias*, *vespertilionis* is the most useful, and if potted in good rich soil will make large fronds of a soft glaucous green. It has spreading rhizomes and requires plenty of pot room. The beautiful little *Pteris scaberula* may be mentioned; this requires very careful treatment, especially when dividing or repotting. Good loam should be used, and plenty of drainage.

LOMARIAS, BLECHNUMS, AND DOODIAS

The two genera *Lomarias* and *Blechnums* are so closely allied that it is difficult to separate them. Take *Lomaria gibba*, this has the congested fertile fronds while the variety *platyptera*, has what appears to be the spore cases on the mid rib of the leafy fronds. I have found many seedlings of this among those of *gibba*, but have never succeeded in raising any from its own spores. And it may be added that *platyptera* in appearance more closely resembles *Blechnum Braziliense*. For all practical purposes it may be as well to refer to them under the names that they are most generally known by. Most of the *Lomarias* come from the temperate regions of Australia, New Zealand, and Chili, and though usually classed as greenhouse Ferns, they succeed better when given more warmth, especially during the time they are growing. They are not so particular as to compost so long as it is open and porous, with good drainage. As with most Ferns which make stems, they like moisture from below and a dry surface above the fronds, and a little sphagnum moss bound round the stems gives them considerable assistance.

Lomaria gibba is one of the most popular species. Of this we have considerable variation in that known as the ordinary type, and in addition to the one referred to above there are several distinct varieties including a crested form.

L. ciliata is another useful species of which we have many distinct varieties and several appear to bear some affinity to *L. gibba*: *grandis*, *major*, and *princeps* are all far superior to the ordinary type. Most of those which make stems are referred to in the chapter on Tree Ferns. *Lomaria Pattersoni elongata* is quite a distinct species, having narrow fronds, sometimes lobed or pinnatifid when the plants are growing vigorously, the young

barren fronds have a bronzy metallic hue. The fertile fronds are narrow and the whole surface covered with the sori (or spore cases). This is a useful Fern for the Greenhouse Rockery.

L. procera is another distinct species which has rather large pinnate fronds of a pale green, produced from a thick prostrate stem, and throwing out thinner rhizomes or stolons from which young plants are produced. This is almost if not quite hardy and makes a fine fern for an elevated position on the Rockery.

Blechnums.—Of these *Brazilienze* is one of the largest growing and forms an erect stem. *Corcovadense* is of similar growth, but has more undulated fronds, and a lovely pink tint when young. *B. occidentale*, *B. polypodioides*, and *B. latifolium* are all of neat growth, and, when exposed, the young fronds are highly coloured, and gradually change to deep green in the two last named, and in *occidentale* they are of a pale soft green when matured.

Doodias.—These are nearly allied to the foregoing genera, and include a few very pretty species, of which *D. aspera* is one of the most useful. It has erect fronds, with stiff, almost black stipes; the young fronds have a beautiful rosy tint, changing to deep green. *D. a. multifida* has much smaller fronds, which terminate in a tasselled crest and droop over, and are even brighter when young than the parent. *D. media* and *D. caudata* all do well under cool treatment, similar to that recommended for the *Lomarias*.

CHAPTER XIX

HARDY FERNS

IN the culture of our British and other hardy Ferns it must be remembered that under their natural conditions they have some protection during the winter from their own fronds which have ripened off, and also from leaves and other vegetable matter, which also provides new material for the roots the following season. And another point is that they get more moisture when dormant than they often do when in active growth. In the Rock Fernery, or when planted out, there is not much danger of damage through drought, but when grown in pots it is different, and having seen many losses through being kept too dry, it seems necessary to call attention to the necessity of keeping the roots fairly moist during the Winter. They should not be flooded with water, but should have sufficient to keep the roots fresh and ready to supply assistance when active growth sets in. It is safe to say that it is here where many failures occur, for after Ferns have had a dormant period, when they do start they soon exhaust the stored-up energy, and the roots must be ready to follow on with further supplies of nutriment, and it is at this period when watering must have careful attention. Special care should be taken not to sour the soil by excessive moisture. In nature it is only those which happen to find congenial conditions that survive. It may be as well to point out that spores being produced in such great abundance, it would be impossible for all the seedlings to survive or to grow,



FROND OF NEPHROLEPIS SUPERBISSIMA
From F. R. Pierson & Co., New York

even if they got a good start, for they would choke one another. Where a large number of seedlings do spring up, it is only the strongest which eventually survive. I have found that under cultivation no Ferns are more prolific than most of our native species. From a single frond of *Athyrium filix-femina* thousands of plants may be raised. And it is so with most others, and to save them they must be divided as soon as the prothalia covers the surface, they are sown upon, they may also require several successive divisions. After they are well established there will be little trouble; potted into small pots and placed in a cold pit, in a shady position where the sun does not reach them, but where they get good light, they will grow freely. Or they may be planted out where they can have protection in severe weather. It may not be desirable to save all the seedlings raised, yet as so much variation is found among them, they should be kept until the best types can be selected.

Speaking of variations, it may be of interest to note that the Royal Horticultural Society made over one hundred awards (mostly first-class certificates) for varieties of *Athyrium filix-femina*, and about the same number for *Scolopendriums*. This is only taking those given up to 1893, and most of these were given between the years 1866 and 1875, a period when the beautiful varieties of our hardy ferns were receiving special attention. Other British Ferns have also been very prolific in variations. It may be added that the same varieties assume different characteristics from year to year. This is especially the case with the crested varieties; in most instances they become more heavily crested with age, it is therefore very difficult to give descriptions, except to some of the most distinct types.

Our British Ferns are represented by about a dozen distinct Genera, and species are not numerous, yet as stated above, varieties are almost countless. They are

widely distinct in form and habit, yet it is remarkable that we have none with tinted or variegated fronds. *Adiantum capillus-veneris* has small fronds of a deep sombre green, which are produced from spreading rhizomes, which will spread and root freely on a brick wall. Frequent instances occur where this Fern, has germinated from spores and covers moist walls. It is the only hardy species, but there are several distinct varieties, the most beautiful of which is *imbricatum*, which has large pinnules, irregularly lobed and undulated. The true form of this does not produce spores, but small bulbils are formed round the margins of the mature fronds, and if these are laid on suitable material in a shady position, young plants may soon be established. *A. c.-v. cornubiense* and *daphnites* are other desirable species. Among seedlings of the type, much variation may be found.

Allosorus crispus (the Parsley Fern) is a distinct little Fern with a tufted caudex; the finely cut fronds rarely attain to more than from three to five inches in length. There is a crested variety of this, but it is rarely seen. This Fern succeeds best in a good loamy compost.

Aspleniums.—The hardy species are mostly of small dimensions. *A. adiantum nigrum*, which is extensively grown in France for supplying the markets with cut fronds, is one of the most useful. It is found in various parts and grows best round the stumps of trees on sloping banks. When grown in pots loam and leaf-mould should be used. There are several varieties, including one with crested fronds, and that grown in France makes larger fronds than any I have seen growing in England.

Athyrium filix-fœmina (the Lady Fern).—This is now included with the *Aspleniums*, yet it is so distinct and so well known as above, that for garden purposes the name may be retained. As mentioned above the varieties are

very numerous, and included very handsome plumose, and also crested forms. Of the varieties, some of the best types are, *Kalothrix*, *plumosum*, *divaricatum*, *pulcherrimum*, *frizellia*, and *Victoria*; of this there are numerous variations. *Vernonia cristata* also varies much. All are entirely deciduous; they grow freely in any good loamy compost. The only time they require any special attention is in the Spring; when young, the fronds are very tender, and are liable to suffer if we get a frost. After they have started into growth, a slight protection when there is any appearance of frost, may save them from being disfigured for the season. When grown in pots they should not be allowed to get very dry, even though they have no fronds, and avoid giving any warmth until all danger of frost is past, for if started early and then exposed they are sure to suffer.

Blechnum spicant (the Hard Fern).—This is also known as *Lomaria spicant*, but that given first is the most familiar. It has pinnate fronds of a thick leathery texture and is evergreen, the barren fronds spread and the fertile fronds are longer and stand erect. There are several varieties, including some pretty crested forms. It grows most luxuriantly in shady dells where the surface is annually covered with leaves, but the roots will penetrate into the loam beneath. It is not such a useful Fern for pot culture as many, but if desirable to grow it, good loam and leaf-mould with sand added, and the plants may be potted fairly firm. There are several small growing varieties, also some with terminal crests, and some with branching fronds.

Scolopendrium vulgare (the Heart's-tongue Fern).—In this we have a very large number of varieties. The true type has rather long strap-shaped fronds of a thick leathery texture, with a bright green surface. This and all its varieties are evergreen. They are found growing under various conditions, and in a wild state a good

many distinct forms are found; but most of the crested varieties have been raised under cultivation. Although found under such widely different conditions, they succeed best on shady banks where there is a good depth of light loamy soil, the leaves which accumulate providing new material for the surface roots. They are most readily propagated from spores, except in a few instances. *S. v. crispum*, which has been found growing wild in several localities, has rarely been known to produce spores. It is one of the most beautiful varieties, having broad undulated fronds, with a fringed edge. This may be propagated from the stipes (or stems) of well-matured fronds. Cut in lengths of about an inch or rather shorter, if put into clean sand, which should be just moist enough to keep the cuttings from shrivelling, bulbils will be formed, and later on young plants will spring up. After the bulbils have begun to form a little more moisture may be given. In *S. v. Kelwayii*, which is of very dense multifid growth, tiny bulbils are formed on the margins of the well-developed segments, and if these are taken off carefully and treated as young seedlings they will soon make plants. *S. v. Coolingi* is another name for the above. In *S. v. cristatum viviparum*, which was found in Ireland, bulbils are formed on the surface of the fronds, and young plants may be established from them. Of the crested varieties, those with the broad, spreading, terminal growth are the most remarkable. In raising plants from spores many interesting variations occur, and if to start with some of the best defined types are selected, many further variations may be obtained from the seedlings. It should be noted that it is not until the second or third year that the best characters are developed. If seedlings can be planted out in an old pit under a wall, or other shady position, they will give little trouble, and the best can be selected as they come into character.

Polypodium vulgare (the Polypody).—In this species we have a number of distinct and beautiful varieties. The normal form grows freely on old tree stumps, and in shady nooks on the Rockery it succeeds well. With this Fern, when growing naturally, it is greatly assisted by the accumulation of leaves, etc., in which the spreading rhizomes root freely. For this and all its varieties a rough compost consisting of peat, leaf-mould, a little fibrous loam, and sand should be used, and the pots well filled up in the middle, so that the rhizomes can spread. Of the many beautiful plumose varieties, *cambricum* is one of the oldest, and still a popular Fern. This is another plumose Fern which does not produce spores, but it may be readily propagated from divisions of the spreading rhizomes. This also applies to *P. v. trichomanoides* and other plumose forms. The crested varieties, or rather most of them, produce spores. Yet to keep the finest forms true, they should also be propagated by divisions, though seedlings may also be raised. All of the above are evergreen, and have fronds of good substance, which will stand exposure to the sun. It is, however, in shady positions where they are seen at their best.

Polypodium dryopteris (the Oak-Fern).—This is a charming species, with rather small triangular fronds, which are tripinnate, of a soft pale green, and are deciduous. The rhizomes spread freely beneath the surface, and it delights in sheltered nooks. When grown in pots good drainage should be given, and a loamy compost used. Shallow pots or pans are preferable, as they give more room for the spreading underground stems.

Polypodium phegopteris (the Beech Fern).—This is somewhat similar to the above, but has the two lower divisions of the fronds drooping, while the others stand out at right angles. It is rather a mystery that it should be called the Beech Fern, unless it is that it is found in the

vicinity of Beech trees. This is also deciduous, and may be treated in the same manner as the foregoing. It may be added that they must not be allowed to get very dry while dormant.

Polystichum (Shield Fern).—Of these, *P. angulare* (the Soft-shield Fern) is the most useful. Of this Fern there are numerous varieties, and in their natural habitats great variation is found, both in size and substance of the fronds. All are evergreen, with pinnate fronds, the pinnæ being serrated and the stipes clothed with brown scales. The plumose varieties are the most remarkable, and it would be difficult to find anything more beautiful than *P. ang. plumosum* and its closely allied varieties; the fronds are broad towards the base and gradually taper off; the elongated segments overlap each other. Some varieties are proliferous. The ordinary form of *P. a. proliferum* is very pretty, but *pulcherrimum* is a further advance. In addition to those termed plumose there are many beautiful crested varieties. Culture makes a great difference, especially with the plumose and crested forms. If liberally treated when one set of fronds are nearly developed and before others are ready to start, the segments and tufted crests will further develop. Good loamy soil should be used and some manure added. The most luxuriant plants I have seen; have been growing in deep ditches between two hedges, but they also succeed well in more exposed positions, and when undisturbed they make quite large specimens.

Polystichum aculeatum differs but little from the above, except that the fronds have more substance and a bright surface, and the pinnæ are more acutely pointed. The variety *P. ac. pulcherrimum* is one of the most beautiful Ferns we have; the curved pinnules overlap each other. This is another which has failed to produce spores. There are also a few good crested varieties, but these are not so numerous as in *angulare*.

Polystichum lonchitis (the Holly Fern).—This is a distinct species, which is found growing in elevated positions; the fronds are of great substance, and the pinnæ have sharp, spiny points. This requires careful treatment; too much warmth when it should remain dormant or over-watering may prove fatal.

Cystopteris fragilis (the Bladder Fern).—A deciduous Fern, with slender, finely-cut fronds, which are freely produced from spreading rhizomes. There are several slight variations, including a good crested form. They are not of much value for pot culture, but on the rockery they make pretty patches of green in any nook where most plants would fail.

Lastrea filix mas. (the Male Fern).—This is one of the best known British Ferns we have. In many town and suburban gardens it may be seen growing luxuriantly. Though quite deciduous the fronds do not die off until quite late in the Autumn, and new ones come up again early in the Spring. Its great recommendation is that it will grow in almost any position, forming masses of bright green under the shade of a house where few other things would grow; yet it is by no means particular, for it will succeed almost as well where it is fully exposed to the sun. There are several pretty crested forms, and considerable variation is found among plants in their natural habitats. When replanting, they should be put down deep, leaving only just the crown showing.

Lastrea pseudo-mas.—This, which is a sub-division of the above, has the distinction of being evergreen, except where very much exposed, but the old fronds usually die off soon after new ones are developed in the spring. There are some remarkably pretty crested forms of this which are worthy of a place in any hardy or greenhouse collection.

L. p.-m. cristata fimbriata has very narrow fimbriated

pinnæ. All the side pinnæ terminate in a light crest. *ramo-cristata*, *crispa cristata*, and others are very pretty.

Lastrea dilatata.—This has large fronds of a soft texture. The side divisions are rather distantly placed on a long rachis. Under ordinary culture the fronds attain to from two to three feet in length, but may be found with larger fronds. This is deciduous, and dies down early in the Autumn. It is only suitable for growing in the open where space is not limited, but there are several very pretty crested forms which should be included in any collection of hardy Ferns.

Pteris aquilina (the Common Bracken).—It is hardly necessary to refer to this Fern except to say that where it is desirable to establish it the best means is by planting seedlings which have been raised and grown on in pots. Planted out in the spring, they will get a good start before the following winter. Many failures have occurred where the old rhizomes have been replanted. There are some rather pretty crested varieties, and in a young state they are very pretty when grown in pots.

Cetrach officinarum is a distinct Fern, but not of great value for ordinary culture. It is rarely found except growing on old walls, and when grown in pots old mortar rubble should be mixed with the soil, and plenty of drainage should be given. This Fern rarely makes fronds more than a few inches long with short rounded pinnæ, the under surface of the fronds being clothed with brown hairy scales, and the surface of a silvery grey shade.

Botrychium lunaria (the Moonwort) and *Ophioglossum vulgatum* (the Adder's-tongue Fern) are interesting curiosities, but of little decorative value. They may be classed with the flowering Ferns; each produces a solitary frond with the fertile portion rising from the base of the leafy fronds. They are found growing in meadows and are difficult to re-establish.

NORTH AMERICAN FERNS

To the list of hardy Ferns which are natives of Great Britain may be added some very pretty species and varieties which come from North America and prove hardy in this country. There are also a few from Japan, which in sheltered positions prove quite hardy. Of those from North America, *Adiantum pedatum* is one of the most interesting. This is deciduous, and the size of its fronds will depend much upon the strength of the clumps. The large imported clumps, if they arrive in good condition, will make fronds nearly two feet high the first year, and they can be grown larger. For the outside Rockery in any sheltered nook it is one of the best Ferns we have, or grown in pots it is equally effective. Though it is deciduous it does not lose its fronds until late in the Autumn, and new fronds spring up early in the year.

Osmunda gracilis is another remarkable Fern. A friend writing from America informs me that it is seen in swampy ground growing as luxuriantly as we see our common Bracken here. This Fern succeeds best in loamy soil and where the roots can reach the water of a running stream. *Osmunda cinnamomea* and *O. claytoniana* are also desirable species. In the latter leafy pinnæ are produced above the contracted fertile pinnæ. With strong crowns these both make large fronds.

Aspleniums, *angustifolium*, *ebeneum*, and *thelypteroides* are useful hardy species. *Allosorus acrostichoides* is a pretty, small, growing deciduous Fern with finely cut fronds. *Onoclea sensibilis* is another pretty North American Fern referred to elsewhere. *Lygodium palmatum*, though hardy, is safer when grown in a cool house. *Polystichum acrostichoides* and the variety *grandiceps* are useful for the Rockery, and there are other North American Ferns which may be planted. They all do best where they

are shaded from the early morning sun, and should have a little protection in very severe weather. The time that they are most likely to suffer is when we get late frosts in the Spring.

Of the Japanese Ferns which may be regarded as hardy in our climate, *Cyrtomium falcatum* and *C. Fortunei* will survive most winters if they are in a fairly sheltered position. *Struthiopteris orientalis* is a pretty deciduous species. *Lastrea Sieboldi* is a very pretty Fern. *Polystichum setosum*, one of the most desirable, but more useful for the unheated greenhouse than to be fully exposed. And it may be safely said of all our hardy Ferns that they are particularly suitable for planting in an unheated greenhouse where they get very little sun. It is where the sun comes on only at the latter part of the day that they do best.

CHAPTER XX

SELAGINELLAS

THE *Selaginellas* do not properly belong to the *Filices*, or Ferns, but they are nearly allied and always associated with them. There are numerous species, many of which are very elegant, and they vary much in habit, some forming dense masses of moss-like growth, while there are many intermediate forms, and *S. casia arborea* of gardens, or *Willdenovi* of Botanists, and sometimes named *levigata*, is of scandent habit. When growing freely under stove treatment this has a beautiful metallic blue tint, but under cooler treatment it has a bronzy hue. It may be used for twining round pillars or for growing against a warm moist wall; it grows freely. Rough peaty compost should be used for potting or planting and good drainage given.

Nearly all the *Selaginellas* require heat and moisture. They may be divided into two sections, some having a very dwarf spreading habit and others growing more erect. Taking first those which are of most use for general purposes, the best known is *S. Kraussiana* (frequently named *Lycopodium denticulatum*). This makes a nice edging for a greenhouse stage, and though almost hardy, will do equally well under stove treatment. *S. Kraussiana aurea* is a distinct yellow variety when well exposed, and in the Spring it is very bright. *S. Kraussiana variegata* has white tips to all the growths when growing freely, but does not keep its colour always. *S. Browni* is said to be a variety, but is very distinct, and fails when given too

much warmth. *S. Poulteri* forms a neat mass of deep green, and is very free growing. The spores of this germinate freely, and seedlings will spring up whenever they fall on moist soil. Of those which grow taller and succeed well in an intermediate temperature, *Martensi* is one of the most popular, and there is a variegated variety, but to keep this true, the best variegated shoots must be selected to propagate from. If left alone it will soon revert to the normal green form, for the green shoots soon overgrow the variegated, which are not so vigorous. This species and many others produce roots from the stems which as soon as they reach the soil soon form a mass of fibrous roots. Propagation is a very simple matter. *S. formosum* is a rather more slender growing variety. These are all grown extensively for market. *S. cuspidata* is another free growing species. *S. serpens* is a dwarf spreading species which will grow freely over the stones on a Rockery or cover a moist wall, but requires more warmth than those above referred to. *S. apus* (or better known as *apoda*) forms a dense mass of moss-like growth, but does not spread so much. *S. Emiliana*, which though quite distinct is considered to be a variety of *cuspidata*, makes a very pretty plant with a rosette-like crown, and does not spread—this is extensively grown for decorations. It must be propagated from the small tips, which may be treated in a similar manner to small Ferns. After once getting a start they soon make pretty little plants, and when in about 2 or 3 inch pots they are very useful, or they may be grown on larger, and will attain to about 9 inches high. *S. amœna* is another distinct variety supposed to come from *S. caulescens*, but is of more wiry growth, with erect stems and nearly horizontal feather-like branches. The erect stems are produced from creeping rhizomes, and though divisions may be made, it is desirable to propa-

gate as recommended for *Emiliana*. This variety is also much in demand for decorations, and being of a wiry texture, it stands a dry atmosphere well, though when growing plants on, they should have moisture. *S. unctinata*, generally known as *casia* (or the blue *Lycopodium*) is of dwarf spreading habit, and when growing freely has a decidedly blue tint. The terminal or fertile portion of the growths lose the bright tint, and the broad flat branches from the base should be selected for propagating from. Several of these, put together in small pots, soon grow, and come in useful for edgings, but it will not stand much exposure. This and several others of dwarf habit form pretty pyramids. For this purpose large shallow pans may be used, the soil built up round an inverted pot. This may be kept in position by binding narrow slips of galvanized wire netting round with some sphagnum. After the pans are prepared, small cuttings may be pricked in round the whole surface, and if placed in a warm moist position they will soon start away. The soil must be pressed moderately firm and should be of a light fibrous nature. Another way of building up the pyramids is to use pans of various sizes, starting with a large one, and each succeeding one should be smaller, leaving room to put in a row of cuttings or young plants. Use light rubble or cinders for filling the centre portion, or any suitable material to avoid making too much weight. These of course are only suitable for those who make a special hobby of them, or want something novel for exhibition, but when well done they are very effective. For six varieties most suitable, the following may be selected, viz.—*Kraussiana aurea*, *casia*, *serpens*, *Poulteri*, *apus*, and *patula*, or any other of the dwarf spreading species would be suitable.

Taking the choicer sorts, which are not of much use except for the stove or where collections are grown, *S. grandis* is one of the most beautiful. It has a

creeping stem, from which grow erect shoots with broad, drooping terminal branching frondlets. The well-developed branches terminate with a long, fertile raceme. This requires treatment similar to that given to the stove filmy Ferns. *S. Victoria* is a handsome species with broad spreading branches of a pale green. *S. erythropus* has red creeping stems, throwing up upright shoots which also have a red bronze shade. The branches are of a soft green, but when well exposed have a bronzy shade. *S. umbrosa* is said by some authorities to be synonymous, yet that seen in some nurseries under the name of *umbrosa* is quite distinct, and has green stems, grows taller, and has drooping branches. *S. Lyall*, which is said to be a variety of the true *levigata*, is a distinct and beautiful form, with thick, dark green stems, and foliage reminding one of a *Thuja* branch. It is of rather slow growth, but should be found in every collection. *S. perelegans* grows rather tall and makes a beautiful plant. *S. hamatodes* is another very pretty species but rather soft. *S. lepidophylla* forms a rosette-like growth, and when dried curls inwards and will open again when put into water. It is often imported in a dry state, and sold as the "Resurrection Plant."

Many other interesting and pretty species might be named.

In regard to culture, though they love a moist, humid atmosphere, many will thrive under comparatively dry conditions; none like heavy shading. And stagnation at the roots must be avoided—potted in light porous compost with good drainage. And the choice sorts will thrive better if stood over a bed of sphagnum moss.

CHAPTER XXI

FERN ENEMIES

UNDER genial conditions Ferns are not so much troubled with insect pest as many plants are. Yet neglect, and the want of ordinary care, may bring about many troubles, and in many instances the mischief is not detected until it is too late to remedy the evil. There is a tiny little black snail which, if it gets a start, will play sad havoc, and a little black slug is equally destructive. Yet these are not difficult to trap. Slices of turnips, carrots, or potatoes laid about on the stages, or among the Ferns on the Rockery, will be a greater attraction than the Ferns, and the slugs or snails will be easily captured, for they will remain underneath, and by going round and examining the traps they may be caught. On stages, a good dusting of powdered lime, or lime water, will prove effective; but lime must be used with care.

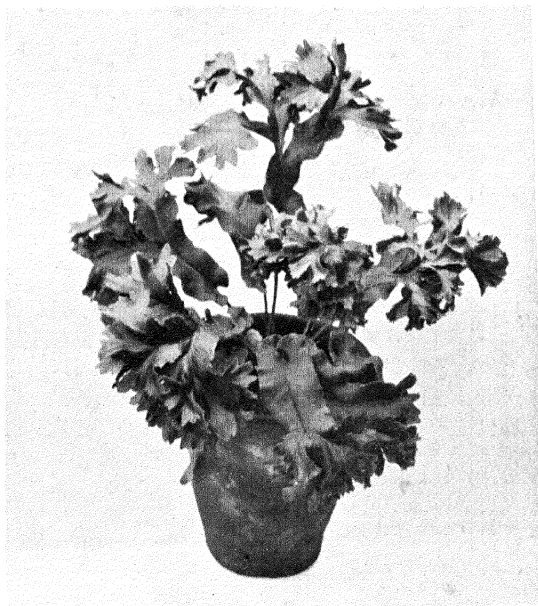
The greatest trouble that Fern growers have had to encounter is a modern introduction. Since Ferns have been grown more exposed, and under drier conditions, a little brown mite has proved most troublesome. This mite attacks the fronds when they are quite young, and as they advance they are crippled and distorted. The insect referred to appears to be the same as that which proves such a trouble with *Begonias*, *Bouvardias*, *Gloxinias*, etc., but does not grow so large, and it is difficult to detect it with the naked eye, but with a good lens it may be found on the main veins. The difficulty with this is that as soon as a plant is touched the insect will fall on to the

soil. The best method of checking its progress is to clean off the surface soil after plants have been fumigated. Water the stages with strong insecticide or weed-killer. Lime and sulphur in equal parts may be dusted into the crowns of plants affected.

The ordinary thrips may give trouble, and it is remarkable that this is very partial to Ferns which properly belong to the cool house.

Take the *Cyrtomiums*, *Gleichenias*, and some of the hardy *Pterises*, when grown in warmth if there are any thrips about they are sure to find the Ferns, and will soon increase. It may be worthy of remark that with thrips the eggs are laid and it takes a few days for them to mature; and when fumigating for thrips it is necessary it should be done about three times successively, at intervals of two days. The ordinary brown scale will often get established, especially on *Aspleniums*, yet it only wants care and perseverance to exterminate it. The great mistake that is often made is that they are left until the spawn is ripe, and when the old covers are removed it lets loose myriads of small ones. One of the best growers always isolated any new introductions until he was quite sure that they were clean, and by this means much labour was saved. Mealy Bug, when once it gets established, is most difficult to eradicate. It will live under the rims of the pots and in any crevice that it can creep into, and remain until a favourable opportunity occurs for it to establish on the plants. If this pest is confined to a few plants it will be much cheaper to burn them and replace with young, clean plants. Pots have often conveyed Mealy Bug to what had previously been clean plants, and even with old soil some troublesome insects may be introduced.

In the out-door Fernery it is necessary to leave some of the old fronds during the winter to protect the plants, but where the temperature is kept above freezing-point



SCOLOPENDRIUM VULGARE
Var. ramo-digitatum majus
Taken at Messrs. H. B. May & Sons' Nursery

if old fronds are left they may harbour insects, which will soon be active when new growth starts in the spring. Cockroaches and woodlice may prove destructive, but there are now preparations which effectively eradicate these pests.

- With a clean start, and ordinary attention, Ferns are rarely troubled with insect pests, but the vermin once introduced, and allowed to get established, it will give a lot of trouble before they can be exterminated.

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